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# Effect of Organic and Inorganic Fertilizers on the Growth and Yield of Tomato (*Solanum Lycopersicum*) under Protected Cultivation

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***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 present investigation titled "Effect of organic and inorganic fertilizer on growth and yield of tomato under protected cultivation" was carried out during 2022 in Central Horticulture Research Farm of Department of Horticulture, SHUATS, Prayagraj to assess the impact of different doses of organic and inorganic fertilizer on the growth and yield of tomatoes under protected condition, as well as to analyze the economic aspects of different treatments. The experiment was conducted in Randomized Block Design with 10 treatments replicated thrice. The treatments were $T_0$ Recommended dose of fertilizers (RDF), $T_1$ 75% (RDF) +25% (Vermicompost), $T_2$ 50% (RDF) +

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50% (Vermicompost), $T_3$ 25% (RDF) +75% (Vermicompost), $T_4$ 75% (RDF) + 25% (FYM), $T_5$ 50 %(RDF) +50% (FYM), $T_6$ 25 %(RDF) +75% (FYM), $T_7$ 75% (RDF) + 25% (Poultry Manure), $T_8$ 50% (RDF) +50% (Poultry Manure), $T_9$ 25% (RDF) +75% (Poultry Manure). On the basis of our finding the best treatment was found to be $T_6$ (25% RDF + 75% FYM) which was found best in terms of growth parameters and yield parameters among different treatment combinations of tomato. Also the best B:C ratio 3.84 was found in $T_6$ (25% RDF + 75% FYM).

*Keywords: Vermicompost; FYM; poultry manure; yield; growth; randomized block design.*

## 1. INTRODUTION

"Tomato, botanically known as *Solanum lycopersicum* L. or *Lycopersicon esculentum* Mill. belongs to the family *Solanaceae* bearing chromosome number 2n=2X=24 and originated from South America" [1]. One of the most well-liked and widely-cultivated vegetable crops, it is regarded as "protective food" everywhere. After the potato and sweet potato, it ranks highly among vegetables and is a great source of vitamins, vegetable protein, and minerals [2,3]. "Love of apple in England" is the nickname for the tomato. Tomatoes are used in a variety of items, including soup, salads, pickles, ketchup, puree, sauces, tomato paste, and tomato juice. The tomato fruit's pulp and juice are easily digestible, mild aperients that encourage gastric secretion and purify the blood [4-7].

"The tomato plants typically grow 1-3 meters in height and have a weak stem that often sprawls over the ground and vines over other plants. Flower are generally borne in clusters of 4 to 8 but small fruited type may have 30 to 50 flowers per cluster. Tomato plants are dicots, and grow as a series of branching stems, with a terminal bud at the tip that does the actual growing" [1].

"Tomato plays a major role in human nutrition, fruit contain 93.1% water, 1.9% protein, 0.3 g fat, 0.7% fibre, 3.6%carbohydrates, 23 calorie, 320 I.U vitamin A., 0.07 mg vitamin B1, 0.01 mg vitamin B2, 31 mg vitamin C, 20 mg calcium, 36 mg phosphorus and 0.8 mg iron. Tomato has valuable vitamins and cholesterol. Approximately 20–50 mg of lycopene per 100g of fruit weight can be obtained from tomato. The best fruit color and quality is obtained at a temperature range of 21-24°C. The tomato is one of the most adaptable crops in the world due to its rapid and widespread climatic adaptation, and it is regarded as a food that provides protection everywhere" [1]. A diet that is healthy and well-balanced benefits from tomatoes. They are abundant in dietary fiber, carbohydrates, vital amino acids, minerals, and vitamins. Tomato seeds, which have a 24% oil content, are used to make margarine and as salad dressing [8-11].

"In general, food security in world is very important because the large population and the better living standard need more food. In conventional agriculture, farmers use inorganic fertilizers to increase nutrient availability to increase crop production" [12-14]. However, in the long term, "the use of inorganic fertilizers can reduce soil fertility and crop productivity. Although organic fertilizer is environmentally friendly, it produces less than inorganic fertilizers. In this regard, by spreading organic manure , in combination within organic fertilizer we can increase production as well as improve soil health. In addition, this combined application maximizes the use of available organic resources and minimizes the use of expensive inorganic fertilizers" (Manral and Saxena, 2003; Ghosh et al.,2004). "We hypothesized that incorporation of organic and inorganic fertilizers may provide better yield and quality of crop with improvement in soil health. Therefore, the present study was conducted to evaluate the performance of tomato varieties with different combinations of organic and inorganic fertilizers". (Manral and Saxena, 2003; Ghosh et al.,2004).

## 2. MATERIALS AND METHODS

The present investigation was done to find out the effect of organic and inorganic fertilizers at different doses combination on growth, yield and quality of tomato under protected cultivation variety Romon. The experiment was carried out at Horticultural Research Farm (HRF), Department of Horticulture, Naini Agricultural Institute SHUATS, Prayagraj, U.P., during the *Rabi* season of 2022. The different combination doses of organic manures and inorganic fertilizers mentioned in Table 1 and replicated thrice. Observations were recorded at different stages of growth periods.

**Table 1. Treatment details**

| Notation | Treatment combination |
|---|---|
| $T_0$ | 100% Recommended dose of fertilizers (RDF) ( 180:100:80) |
| $T_1$ | 75% (RDF) +25% (Vermicompost) |
| $T_2$ | 50% (RDF) + 50% (Vermicompost) |
| $T_3$ | 25% (RDF) +75% (Vermicompost) |
| $T_4$ | 75% (RDF) + 25% (FYM) |
| $T_5$ | 50 %(RDF) +50% (FYM) |
| $T_6$ | 25 %(RDF) +75% (FYM) |
| $T_7$ | 75% (RDF) + 25% (Poultry Manure) |
| $T_8$ | 50% (RDF) +50% (Poultry Manure) |
| $T_9$ | 25% (RDF) +75% (Poultry Manure) |

**List 1. Physical properties of soil at horticulture research field (SHUATS) [1]**

| S. No. | Particulars | Mechanical properties |
|---|---|---|
| 1 | Sand | 48.15 |
| 2 | Silt | 21.34 |
| 3 | Clay | 30.51 |
| 4 | Textural class | Sandy loam |

**List 2. Chemical composition of the soil**

| S. No. | Ingredients | Quantity |
|---|---|---|
| 1 | Soil pH | 6.9 |
| 2 | Organic carbon (%) | 0.358 |
| 3 | Available Nitrogen | 212.56 kg/ha |
| 4 | Available Phosphorus | 14.59 kg/ha |
| 5 | Available Potash (K) | 225.1 kg/ha |

## 3. RESULTS AND DISCUSSION

### 3.1 Plant Height

The height of plant significantly varied among different treatment combinations. The highest plant height (259.22 cm) at 30 DAT was observed with treatment $T_6$ ($T_6$-25% RDF + 75% FYM) followed by $T_7$ (75% RDF + 25% Poultry manure) with 258.98 cm. Minimum plant height (248.18 cm) was observed in $T_0$ (100% Recommended dose of fertilizer), while the remaining treatments are moderate in their growth habit.

### 3.2 Earliness Parameter

#### 3.2.1 Days to first flowering and days to 50% flowering

Maximum days to 1$^{st}$ flowering and 50% flowering was recorded (31.05, 49.11) in T0 (100% RDF) followed by (30.18, 48.67) in T9 (25% RDF + 75% Poultry manure) and minimum (27.25, 45.22) in T6 (25% RDF + 75% FYM). Similar results have also been reported by Singh and Tiwari (2013), Dixit et al. [15] and Singh et al., [16].

#### 3.2.2 No. of flower/cluster, fruits set/ cluster, No. of flower cluster/ plant

The effect of suitable doses of organic and inorganic fertilizer on number of flower/cluster of tomato is very obvious. There was significant difference among the doses of the different treatments, among the treatment applied the maximum number of flower/cluster was recorded in $T_6$ (25% RDF + 75% FYM) with (10.58) which was followed by $T_7$ (75% RDF + 25% Poultry manure) with (10.25) which was significantly superior over $T_0$ (100% Recommended dose of fertilizer) with (7.45) number of flower/cluster. There was significant difference among the doses of the different treatments, among the treatment applied the maximum number of flower/cluster was recorded in $T_6$ (25% RDF + 75% FYM) with (7.48) which was followed by $T_7$ (75% RDF + 25% Poultry manure) with (7.19) which was significantly superior over $T_0$ (100% Recommended dose of fertilizer) with (5.75) fruit set/cluster. among the treatment applied the maximum number of flower/cluster was recorded in $T_6$ (25% RDF + 75% FYM) with (13.23) which was followed by $T_7$ (75% RDF + 25% Poultry manure) with (12.96) which was significantly superior over $T_0$ (100% Recommended dose of fertilizer) with (10.02) flower cluster/plant. Similar findings were reported by Sathyamurthy et al. [17]; Reddy et al. [18]; Singh et al. [16] in tomato.

### 3.3 Yield Parameters

#### 3.3.1 Number of fruits per plant

The effect of suitable doses of organic and inorganic fertilizer on number of fruits per plant of tomato is very obvious and consistent. There was significant difference among the doses of

**Table 2. Effect of organic and inorganic fertilizer on different parameters and yield related traits in tomato under polyhouse**

| Treatment Notation | Treatment details | Plant height (120 DAT) | Days to first flowering | Days to 50% flowering | No. of flowers /cluster | Fruit set per cluster | No. of flower clusters /plant | Number of Fruit per plant | Fruit yield per plant (kg) | Fruit yield (250 sq. meter) (quantal) |
|---|---|---|---|---|---|---|---|---|---|---|
| $T_0$ | 100% Recommended dose of fertilizer | 248.18 | 31.05 | 49.11 | 7.45 | 5.75 | 10.02 | 57.61 | 4.65 | 55.79 |
| $T_1$ | 75% RDF + 25% Vermicompost | 250.22 | 29.32 | 48.89 | 8.12 | 6.14 | 10.93 | 67.11 | 5.52 | 66.23 |
| $T_2$ | 50% RDF + 50% Vermicompost | 250.62 | 29.90 | 46.33 | 8.32 | 6.23 | 10.83 | 67.47 | 5.57 | 66.82 |
| $T_3$ | 25% RDF + 75% Vermicompost | 253.42 | 29.27 | 45.33 | 9.02 | 6.26 | 11.06 | 69.23 | 5.73 | 68.74 |
| $T_4$ | 75% RDF + 25% FYM | 257.08 | 29.78 | 47.11 | 9.95 | 7.17 | 11.09 | 79.51 | 6.84 | 82.05 |
| $T_5$ | 50% RDF + 50% FYM | 255.55 | 29.08 | 46.77 | 10.12 | 6.42 | 11.36 | 72.93 | 6.07 | 72.82 |
| $T_6$ | 25% RDF + 75% FYM | 259.22 | 27.25 | 45.22 | 10.58 | 7.48 | 13.23 | 98.96 | 8.63 | 103.53 |
| $T_7$ | 75% RDF + 25% Poultry manure | 258.98 | 28.08 | 47.21 | 10.25 | 7.19 | 12.96 | 93.18 | 8.03 | 96.33 |
| $T_8$ | 50% RDF + 50% Poultry manure | 251.39 | 28.99 | 48.56 | 7.79 | 6.93 | 10.6 | 73.45 | 6.16 | 73.90 |
| $T_9$ | 25% RDF + 75% Poultry manure | 254.72 | 30.18 | 48.67 | 10.22 | 6.92 | 12.06 | 83.45 | 7.11 | 85.29 |
| 'F' test | | S | S | S | S | S | S | S | S | S |
| S.E. (m) ± | | 1.319 | 0.757 | 0.765 | 0.692 | 0.299 | 0.848 | 0.776 | 0.209 | 0.542 |
| C.D. at 5% | | 2.722 | 1.563 | 1.579 | 1.428 | 0.618 | 1.751 | 1.602 | 0.431 | 1.118 |
| C.V. | | 22.840 | 12.392 | 12.306 | 11.984 | 5.186 | 14.696 | 12.825 | 3.618 | 9.380 |

the different treatments, among the treatment applied the maximum number of fruit per plant was recorded in $T_6$ (25% RDF + 75% FYM) with (98.96) which was followed by $T_7$ (75% RDF + 25% Poultry manure) with (93.18) which was significantly superior over $T_0$ (100% Recommended dose of fertilizer) with (57.61) number of fruit per plant. Similar findings were reported by Yadav et. al,. (2017); Majumdar et. al., (2018); Singh et al. [16] in tomato.

### 3.3.2 Fruit yield/plant (kg)

The effect of suitable doses of organic and inorganic fertilizer on fruit yield per plant of tomato is very obvious and consistent. There was significant difference among the doses of the different treatments, among the treatment applied the maximum fruit yield per plant of tomato was recorded in $T_6$ (25% RDF + 75% FYM) with (8.63 kg) which was followed by $T_7$ (75% RDF + 25% Poultry manure) with (8.03 kg) which was significantly superior over $T_0$ (100% Recommended dose of fertilizer) with (4.65) kg. These results are in close conformity with the findings of Sivaiah et al. [19]; Ali et al. [20]; Haleema et al. [21]; Satyamurthy et al. [17]; Pandiyan et al. [22]; Singh et al. [16] and Shnain et al. (2021) as reported in tomato.

### 3.3.3 Yield/250 sq. m (q)

The effect of suitable doses of organic and inorganic fertilizer on fruit yield per 250 $m^2$ of tomato is very obvious and consistent. There was significant difference among the doses of the different treatments, among the treatment applied the maximum fruit yield per 250 $m^2$ of tomato was recorded in $T_6$ (25% RDF + 75% FYM)with (103.53 Qt)which was followed by $T_7$ (75% RDF + 25% Poultry manure) with (96.33 Qt) which was significantly superior over $T_0$ (100% Recommended dose of fertilizer) with (55.79) Qt. These results are in close conformity with the findings of Kazemi (2013); Saravaiya et al. [23]; Ali et al. [20]; Haleema et al. [21]; Satyamurthy et al. [17]; Pandiyan et al. [22]; Singh et al. [16] and Shnain et al. (2021) as reported in tomato.

## 4. CONCLUSION

Hence, it is concluded that $T_6$ (25% RDF + 75% FYM) was found best in terms of growth parameters and yield of tomato under protected cultivation.

## COMPETING INTERESTS

Authors have declared that no competing interests exist.

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