

# Combined Effect of Biofertilizers and Chemical Fertilizers on Growth and Yield of Tomato

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## Abstract

Field experiments were conducted to study the effect of biofertilizers with chemical fertilizers and other organic fertilizers on growth and yield of Tomato (Rajashree, by Mahatma Phule Krishi Vidyapeeth Rahuri). Three types of biofertilizers viz. Azospirillum, phosphate solubilizing bacteria (PSB) and vesicular arbuscular mycorrhizas (VAM) in different combinations with chemical and other inorganic fertilizers were tested in a randomized block design with two replications. The result revealed that, significantly taller plants, better yield parameters, better fruit quality, higher yield was recorded with the application of 50% N through vermicompost + 50% N through urea. Required quantity of P and K through SSP (Single super phosphate) and MOP (Muret of potash) + Biofertilizer (azospirillum, phosphate solubilizing bacteria (PSB) and vesicular arbuscular mycorrhizas (VAM)).

**Key words:** Bio-fertilizers, Organic fertilizers, Yield, Quality, Brinjal

Tomato (*Solanum lycopersicum* L.) is a popular vegetable crop being cultivated extensively in almost all parts of India. For better yield, farmers generally use chemical fertilizers. Excessive and continuous use of chemical fertilizers has adversely affected the soil causing decrease in organic carbon, reduction in microbial flora of soil, increasing acidity and alkanity of soil [1-2]. The integrated nutrient management has become an accepted strategy to bring about improvement in soil fertility and protecting the environment [3]. This strategy utilizes a judicious combination of fertilizers, organic manures and bio-fertilizers; hence this investigation was carried out to study the effect of integrated nutrient management, i.e. chemical fertilizers, biofertilizers and other organic manures on growth and yield of tomato. Use of organic fertilizers and biofertilizers to crop helps stimulate plant growth, activate soil biologically and restore natural fertility [4]. Biofertilizers are not replacement of fertilizers but can supplement their requirement [5-6]. Hence use of biofertilizers along with organic manures and chemical fertilizers is beneficial.

## MATERIALS AND METHODS

### Experimental details

Field experiments were conducted for two years during *Kharip* 2021 and 2022 at Ale, Tal –Junnar District – Pune (Maharashtra), to study the effect of bio fertilizers with chemical fertilizers on growth and yield of Tomato (Rajashree, by Mahatma Phule Krishi Vidyapeeth Rahuri). Three types of biofertilizers namely azospirillum, PSB and VAM in different combinations with inorganic and organic fertilizers are applied in a randomized block design with two replications. The texture of soil for the field experiment was clay loam.

*The treatments of the crop are as follows*

1. T<sub>1</sub>: RDF (100: 50:50 NPK kg / ha) + 20 T FYM / ha.
2. T<sub>2</sub>: 50% N through vermicompost + 50% N through urea. Required quantity of P and K through SSP (Single super phosphate) and MOP (Muret of potash) + Biofertilizer (azospirillum, phosphate solubilizing bacteria (PSB) and vesicular arbuscular mycorrhizes (VAM)).
3. T<sub>3</sub>: 50% N through vermicompost + 50% N through FYM + Biofertilizer (azospirillum, phosphate solubilizing bacteria (PSB) and vesicular arbuscular mycorrhizes (VAM)).
4. T<sub>4</sub>: 50% N through neem cake + 50% N through FYM + Biofertilizer (azospirillum, phosphate solubilizing bacteria (PSB) and vesicular arbuscular mycorrhizes (VAM)).
5. T<sub>5</sub>: 50% N through vermicompost + 50% N through neem cake + Biofertilizer (azospirillum, phosphate solubilizing bacteria (PSB) and vesicular arbuscular mycorrhizes (VAM)).
6. T<sub>6</sub>: 75% N through poultry manure + 25% N through cotton seed cake + Required quantity of P and K through SSP (Single super phosphate) and MOP (Muret of potash) + Biofertilizer (azospirillum, phosphate solubilizing bacteria (PSB) and vesicular arbuscular mycorrhizes (VAM)).
7. T<sub>7</sub>: Absolute control.

The recommended dose of inorganic fertilizers 100:50:50 kg NPK / hectare were applied as per the treatments. 50% N along with 50 kg of P and 50 kg of K were applied as a basal dose. Remaining 50% N were applied in two split doses i.e. 25% N is applied 30 days after plantation and remaining 25% is applied 45 days after plantation. Other organic and

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inorganic fertilizers were applied as per treatment. The control plot was with no any treatments. Observations on plant height, number of branches, number fruits, fruit weight and yield were recorded and the data were analyzed statistically.

Size of plot - 3.75 meter × 2.70 meter  
Spacing - 90 cm × 75 cm

#### Plant protection

1. Carbofuron 3%, 30 kg/ha and Trichoderma 2.5 kg/100 kg.
2. Use of Pheromone trap for control of shoot and fruit borer moth.
3. Infected shoots are removed and destroyed.
4. 4% Azadirectin is applied at 10 days interval.
5. Infected fruits are destroyed during harvesting.
6. Chloropyrifos and Cypermethrin is applied for thrips and aphids.
7. Dashparni ark is applied at 20 days interval.
8. *Baveria basiana* 40 gm/10 lit of water is applied for fruit and shoot borer.

## RESULTS AND DISCUSSION

The result of this investigation shows that, there are significant differences in various treatments applied to the plant. The result shows that biofertilizers in different combinations with chemical fertilizers and other organic fertilizers shows more yield parameters and growth of plant.

The plant height considered to be an important factor to judge the vigor was found increased to a significant level with the application of organic manures, inorganic manure and biofertilizers. The treatments T<sub>2</sub>, 50% N through vermicompost + 50% N through urea and required quantity of P and K through SSP (Single super phosphate) and MOP (Murate of potash) + Biofertilizer (azospirillum, phosphate solubilizing bacteria (PSB) and vesicular arbuscular mycorrhizes (VAM), recorded the tallest plant height is 166 cm and highest number of branches were 9.5 (Table 1). The increase in growth character might be due to the fact that, biofertilizers inoculated plants were able to absorb more nutrients, NPK rather than other plants [7]. Similar to plant height, the branching was increased due to the application of biofertilizer [8]. The number of branches per plant is of considerable importance and it has positive association with yield [9]. Treatment T<sub>2</sub>, recorded highest number of branches to the plant are 9.5. Graters the number of secondary branches, more will be the number of flowers produce, which is ultimately going reflect the total number of fruits produce.

In tomato, fruit with good glance and colour are preferred. Biofertilizer and Vermicompost application gives fruit with good glance and colour [10]. Biofertilizer inoculation, benefits plant growth and increase yield of crop by improving root development, mineral uptake and plant water relationship [11]. In addition to N fixation, phosphorous absorption, biofertilizers also produces growth promoting substances like IAA and GA and these hormones enhances crop growth [12].

Table 1 Effect of different organic and inorganic material on growth and yield of tomato (Mean of R<sub>1</sub> and R<sub>2</sub>)

| Treatments     | Plant height (cm) | No. of branches / plant | No. of fruits /plant | Average fruit weight (gm) | Yield / plant (kg) | Yield / plot (kg) | Yield/ha (q) |
|----------------|-------------------|-------------------------|----------------------|---------------------------|--------------------|-------------------|--------------|
| T <sub>1</sub> | 162.5             | 9.0                     | 37.5                 | 55.50                     | 2.07               | 49.95             | 493.39       |
| T <sub>2</sub> | 166               | 9.5                     | 40.5                 | 58.00                     | 2.36               | 56.86             | 561.65       |
| T <sub>3</sub> | 156.5             | 8.1                     | 36                   | 51.50                     | 1.85               | 44.48             | 439.34       |
| T <sub>4</sub> | 158               | 8.15                    | 33.5                 | 49.00                     | 1.76               | 39.40             | 413.03       |
| T <sub>5</sub> | 161               | 8.2                     | 34.5                 | 50.00                     | 1.68               | 38.41             | 409.00       |
| T <sub>6</sub> | 162.5             | 9.3                     | 37.5                 | 53.00                     | 1.81               | 47.53             | 471.10       |
| T <sub>7</sub> | 151.00            | 7.05                    | 29                   | 42.50                     | 1.23               | 29.52             | 291.56       |

The highest yield was also recorded with the application of treatment T<sub>2</sub> i.e. 50% N through vermicompost + 50% N through urea. Required quantity of P and K through SSP (Single super phosphate) and MoP (Muret of potash) + Biofertilizer (azospirillum, phosphate solubilizing bacteria (PSB) and vesicular arbuscular mycorrhizes (VAM), due to the height yield contributing characters like number of fruits per plant and average fruit weight.

The N availability through urea and vermicompost and N content of plant was enhanced due to application of azospirillum biofertilizers. The increased uptake of available N influences the growth character. Since N is the chief constituent of protein essential for the formation of protoplasm, which lead to cell division, cell enlargement and ultimately resulting is increased plant growth and yield [13].

The PSB have inherent capacity to dissolve part of fixed phosphorous and make it available to the plant by screening certain organic acids [14]. Hence PSB is also play important role in crop growth and yield. Chemical fertilizers provide the available ratio of NPK to the plant, but when it is applied along with organic fertilizers and biofertilizers, it gives better result.

## CONCLUSION

The growth and yield of tomato were recorded the highest for treatment T<sub>2</sub> i.e. 50% N through vermicompost + 50% N through urea and required quantity of P and K through SSP (Single super phosphate) and MOP (Muret of potash) + Biofertilizer (azospirillum, phosphate solubilizing bacteria (PSB) and vesicular arbuscular mycorrhizes (VAM).

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