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Effect of organic source of fertilizers along with inorganic on growth, yield and quality of tomato (*Solanum lycopersicum* L.) cv. PKM 1

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ABSTRACT : The present investigation was aimed at determining the effect of combined combination of biofertilizers along with chemical fertilizers application on growth and yield parameters of tomato plants. An experiment was conducted at Horticultural College and Research Institute, Periyakulam in the year 2016 Rabi season. The trial was laid out in a Randomized Block Design (RBD) including nine set of treatments with three replications to evaluate the effect of inorganic fertilizers like that N, P and K (75 % and 100% prescribed dosage) with organic fertilizers including *Azospirillum*, *Phosphobacteria*, potash mobilizer (each 1 lit/acre), VAM (5 kg/acre) and humic acid (3 lit/acre) as soil and foliar application along with control. PKM 1 variety of tomato was taken as a test crop. The seedlings were transferred to the main field and inorganic fertilizers (N, P and K) were applied as per the treatment schedule. The organic fertilizer treatment was imposed at 15 days interval three times on the standing crop with varying dosages. Observation parameters like plant height (cm), average number of fruits per plot, average fruit weight per plant (g), yield (tonnes/ha), days to 50% flowering, ascorbic content and TSS were recorded. The treatments T₈[75 % RCF + biofertilizers (*Azospirillum* + *Phosphobacteria* + potash mobilizer + VAM)+ humic acid liquid as soil application] recorded maximum in plant height (73 cm), average number of fruits per plot (59), average weight of fruits per plot (707 g), yield (31.56 t/ha), ascorbic content (17.3 mg/100g) and TSS (5.5 °Brix), followed by T₆ (RCF + biofertilizers – (*Azospirillum* + *Phosphobacteria* + Potash mobilizer + VAM + humic acid liquid as soil application) while the control T₁ recorded lowest. The overall result revealed that 75% inorganic fertilizers combined with organic fertilizers increased number of fruits, weight of fruits and yield, compared to control and the percentage increase in yield was 35% over control.

KEY WORDS : *Azospirillum*, *Phosphobacteria*, *Potash mobilizer*, VAM, Nitrogen, Phosphorus, Potassium, RCF- Recommended chemical fertilizer

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Tomato (*Solanum lycopersicon* L.) under the Solanaceae family, otherwise called as wolf apple, second most important vegetable crops after potato. India is the second largest producer of vegetable after china in the world. In addition to its economic

importance, tomato consumption has recently been demonstrated to be beneficial to human health, because of its content of phytochemicals such as lycopene, β -carotene, flavonoids, vitamin C and many essential nutrients (Beutner, 2001; Ordoorkhani *et al.*, 2010). This

composition explains the high antioxidant capacity in both fresh and processed tomatoes (Gahler *et al.*, 2003), associating the fruit with lower rates of certain types of cancer and cardiovascular disease (Rao and Agarwall, 2000).

In the last century, chemical fertilizers were introduced and this made farmers to be happy of getting increased yield in agriculture in the beginning. But slowly chemical fertilizer started displaying their ill-effects such as leaching, polluting water basins, destroying microorganisms and friendly insects, making the crop more susceptible to the attack of diseases, reducing the soil fertility and thus causing irreparable damage to the overall system.

The nitrogen in adequate quantity increased fruit quality, fruit size, colour and taste. It also helps in increasing desirable acidic flavour. Adequate amount of potassium is also required for growth, yield and quality. However, the nitrates produced in the soil from the added N fertilizers can reach with the organic matter of the soil and deplete even the native humus and may result in the fall of the crop production (Dhar *et al.*, 1968). Hence, this present investigation was carried out to study the effect of combined combination of organic bio fertilizers and inorganic fertilizers on enhancing growth yield and quality of tomato.

RESEARCH METHODS

Field experiment was conducted at western block of Horticultural College and Research Institute, Periyakulam. The PKM 1 variety of tomato was taken as a test crop. Five types of bio fertilizers like as *Azospirillum*, *Phosphobacteria*, *Potash mobilizer*, VAM, and humic acid, were included along with the recommended dose of chemical fertilizer (75:100:50 N, P and K kg/ha) were tested along with control in a Randomized Block Design with three replications. The data were subjected to statically analysis as suggested Panse and Sukhatme (1985).

Treatment details :

- T₁ - Recommended chemical fertilizer (RCF)
- T₂ - Biofertilizers – (*Azospirillum* + *Phosphobacteria* + *Potash mobilizer* + VAM)
- T₃ - RCF + biofertilizers – (*Azospirillum* + *Phosphobacteria* + *Potash mobilizer* + VAM)

- T₄ - RCF + humic acid liquid as soil application
- T₅ - RCF + humic acid liquid as foliar application
- T₆ - RCF + biofertilizers – (*Azospirillum* + *Phosphobacteria* + *Potash mobilizer* + VAM) + Humic acid Liquid as soil application
- T₇ - RCF + biofertilizers – (*Azospirillum* + *Phosphobacteria* + *Potash mobilizer* + VAM) + humic acid liquid as foliar application
- T₈ - 75 % RCF + biofertilizers – (*Azospirillum* + *Phosphobacteria* + *Potash mobilizer* + VAM) + humic acid liquid as soil application
- T₉ - 75 % RCF + biofertilizers – (*Azospirillum* + *Phosphobacteria* + *Potash mobilizer* + VAM) + humic acid liquid as foliar application

The recommended dose of inorganic fertilizers were applied T₁ to T₇ treatments and T₈ and T₉ treatments were 75 % recommended dose of fertilizers was applied. Biofertilizers was applied 15 days interval for 3 times. Observations was taken on vegetative parameters like plant height (30, 60 and 90 days), days to 50 % flowering, yield parameters like, number of fruits per plot, average weight of fruits per plant, yield tonnes/ha, biochemical parameters like ascorbic acid content (mg/100g), total sugar content (%) and TSS (°Brix) were recorded

RESEARCH FINDINGS AND DISCUSSION

The findings of the present study as well as relevant discussion have been presented under following heads :

Growth parameters :

The results indicated significant differences among the kinds of biofertilizers and their combination with inorganic fertilizers. The plant height and days to 50 % flowering considered being an important factor to judge the vigour of plant. It was found increased to a significant level with the application of treatments The treatment T₈ - 75 % RCF + biofertilizers – (*Azospirillum* + *Phosphobacteria* + *Potash mobilizer* + VAM) + humic acid liquid as soil application recorded the maximum height of 33.3, 72.5 and 73.1 cm at 30, 60 and 90 days, respectively and this treatment has taken minimum number of days to attain 50 % flowering (37.7 days) followed by T₆ (RCF + biofertilizers – (*Azospirillum* + *Phosphobacteria* + *Potash mobilizer* + VAM) + humic acid liquid as soil application) followed by the treatments T₇ and T₉ while control T₁ recorded lower plant height of 25, 63 and 68.7 cm at 30, 60 and 90 DAP, respectively

(Table 1). Higher production of auxin and growth substances by humic acid at early phases of growth could have induced the production of lateral branches and plant height. Biofertilizers and combination effect produced highest plant growth as suggested by Alam (2006).

Yield parameters :

The highest yield was recorded with the application of T₈-75 % RCF + biofertilizers – (*Azospirillum* + *Phosphobacteria* + *Potash mobilizer* + VAM) + humic acid liquid as soil application (31.6 tonnes/ha) followed by T₆ of 29.8 tonnes/ha. High yield contributing characters like number of fruits per plot (59), average fruit weight per plot (811g) followed by T₆-RCF + biofertilizers – (*Azospirillum* + *Phosphobacteria* + *Potash mobilizer* + VAM) + humic acid liquid as soil application recorded the next higher values while control recorded lower yield of 23.1 tonnes/ha, average number of fruits per plot (32 nos.) and average weight of fruits per plot (417 g) (Table 2). The combined effects increased

shelf life of fruits, increased the nutrients availability and increased sucrose content of fruits. A balanced use of organic and inorganic fertilizers could enhance soil chemical, physical, and biological properties as well as rate of nutrient turn over within the soil-plant system and increased yield and quality of fruits. Nutrients, when in adequate quantity, increases fruit quality, fruit size, colour, and fruit taste of tomato (Azad, 2000)

Azospirillum fixes the atmospheric nitrogen in the soil enhances the production of phyto hormone like substances and increased uptake of nutrients such as phosphorus and potassium. The biological activity of the microorganisms would have helped the soil status to become a ready to serve zone for essential nutrients to plant's root system. Similar results were reported in coriander (Subramanian and Vijayakumar, 2001).

Quality parameters :

Application of 75 % RCF along with humic acid as soil application recorded lesser ascorbic acid (17.3 mg/

Table 1 : Effect of combined application of organic and inorganic fertilizer on growth parameter of tomato cv. PKM 1

Treatments	Plant height (cm)			50% flowering (days)
	30 days	60 days	90 days	
T ₁	25.0	63.0	68.7	50.0
T ₂	26.3	68.7	70.0	44.0
T ₃	28.3	70.0	70.1	42.0
T ₄	26.3	69.3	70.0	42.0
T ₅	30.3	71.0	71.2	41.3
T ₆	32.7	72.3	72.5	39.9
T ₇	31.0	72.0	72.0	41.0
T ₈	33.3	72.5	73.1	37.7
T ₉	31.7	72.0	72.0	39.0
S.E.±	4.29	3.30	3.27	5.51
C.D. (P=0.05)	NS	7.01	6.95	11.40

NS=Non-significant

Table 2 : Effect of combined application of organic and inorganic fertilizer on yield parameter of tomato cv. PKM 1

Treatments	Average number of fruits per plot	Average weight of fruits per plot (g)	Yield tonnes/ha
T ₁	32.0	417.0	23.1
T ₂	35.0	430.0	24.3
T ₃	39.0	471.0	25.0
T ₄	36.0	457.0	25.0
T ₅	40.0	522.0	25.3
T ₆	55.0	707.0	29.8
T ₇	43.0	584.0	27.6
T ₈	59.0	811.0	31.6
T ₉	48.0	564.0	28.8
S.E.±	6.48	28.94	3.93
C.D. (P=0.05)	12.05	61.35	8.34

Table 3 : Effect of combined application of organic and inorganic fertilizer on quality parameter of tomato cv. PKM 1

Treatments	Ascorbic acid content (mg/100g)	Total sugar content (%)	TSS (°Brix)
T ₁	22.1	6.0	4.0
T ₂	18.6	6.3	4.6
T ₃	18.3	6.4	4.8
T ₄	18.5	6.3	4.6
T ₅	18.2	6.9	4.9
T ₆	17.9	8.5	5.1
T ₇	18.2	7.2	4.9
T ₈	17.3	9.0	5.5
T ₉	18.1	8.2	5.0
S.E. _±	2.75	0.59	0.60
C.D. (P=0.05)	4.86	1.29	1.30

100g), more total sugar (9 %) and TSS of 5.5⁰ Brix followed by T₆ while control T₁ recorded higher ascorbic acid of 22.1 mg/100g and less sugar of 6 % and TSS of 4.0 °Brix.

Conclusion :

Combined application of organic and inorganic fertilizers recorded increased growth, yield and quality parameters in tomato. Therefore, it is advocated that 75 % recommended chemical fertilizer (75:100:50 N, P and K kg/ha) along with biofertilizer like *Azospirillum*, *Phosphobacteria*, *potash mobilizer* (1 lit/ acre)+ VAM (5 kg/acre) along with humic acid (3 lit/acre) as soil application recorded higher yield and quality of tomato crop

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