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Response of tomato metabolism to manures and fertilizers

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Abstract

Tomato (Latin-juicy wolf peach) is a popular, versatile, easily grown plant with a great tasting fruit. Originally cultivated during prehistoric times by the Indians in South America, they were long believed to be poisonous. But now tomato is the favourite of home vegetable gardeners and is widely cultivated and used throughout the world. In this study, tomato plants were treated with organic manures (F.Y.M, Sewage Sludge) and inorganic fertilizers (N.P.K, Zn, S) were analysed for biochemical composition. Phenol, chlorophyll, protein, sulphur, nitrogen, phosphorus and potassium content exhibited an increase at all the test concentrations and were found maximum in sewage sludge treated along with N.P.K (T_7).

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Introduction

Tomato is one of the most important vegetable crop from nutritional as well as consumptional point of view. It tops the list of canned vegetables. The red round fruit is eaten raw or cooked. All green parts of the plant are poisonous. Tomato flowers are similar in shape to many other flowers of the solanum family, like brinjal. One of the most unusual features of the tomato blossom, very different from our Standard Blossom, is this: its anthers are grown together along their edges, forming a column surrounding the pistil's style. Once the flower is pollinated, the little ovary will begin growing very fast. The anther-cylinder around it and the bright petals will dry up, shrivel and fall away. However the sepals will remain and eventually the ovary will be a magnificent tomato.

F.Y.M improves the soil tilth, aeration, water holding capacity of the soil and stimulates the activity of micro-organisms in the soil that make the elements readily available to the crops (Adrian, 2004). On dry weight basis, sewage sludge contains 3 to 6 per cent N, 2 per cent P_2O_5 and 1% K_2O and can become readily available when applied to the soil. Mineral elements like N.P.K, S and Zn too can increase the biochemical composition of tomato.

Therefore the present investigation was undertaken to find out the best combination of organic manures and inorganic fertilizers for obtaining the higher biochemical composition of tomato.

Materials and methods

Present investigation was carried out with crystal HYB-F_1 variety of tomato. The crop was raised in the field of Biochemistry Department. Twelve treatments, replicated thrice were tested in randomized block design. F.Y.M and sewage sludge @ 5 kg/plot (2 x 1 sqm, having 8 plants) were applied before 20 days of transplanting. All inorganic fertilizers viz; N.P.K (108: 214: 33 g), Zn (4.761 g) and sulphur (1.332 g) were given as basal doses.

Biochemical estimations of tomato plants

Phenol, chlorophyll, protein, sulphur, nitrogen, phosphorus and potassium content were estimated by standard methods (Peach, 1955).

Results and discussion

It is evident from the table 1 that all the treatments increased the biochemical constituents of tomato over control. Maximum phenol content was recorded in T_7 (84.61 %) followed by T_{11} (61.53%). Whereas, the minimum increase was observed in T_9 (6.15%) respectively, as compared to the control. These results are in accordance to (Bangal, 1989) who found that N.P.K application has increased the phenol content of tomato plants. Highest chlorophyll and protein content was observed in T_7 (147.22, 44.82%). The next effective treatment in increasing the chlorophyll and protein content was T_6 (134.02 %) and T_{11} (43.34 %) and the least effective treatment was T_4 (46.52 %) and T_2 (3.81 %) respectively, over control. Our findings correlate with the results of (Zubanova, 1975) who reported that some minor elements have increased the chlorophyll and protein content in tomato plants. T_5 observed maximum sulphur retention (50 %) pursued by T_9 (42.85 %). While as, the lowest increase was noted in T_2 (7.14%) as compared to the control. Our observations are in conformity to the findings of (Stratigakos, 1985) who observed that the application of sulphur has increased the sulphur content of tomato plants. Greatest quantity of nitrogen and potassium was recorded in T_7 (44.61, 46.42%). The next effective treatment was T_{11} (43.07, 36.42%) respectively. While as, the least enhancement was observed in T_2 (3.84, 1.42%) as compared to the control. These results are in concordance to (Hamdy, 1971) who recited that the sulphur application has increased the nitrogen and potassium content in tomato plants. Elevated percentage of phosphorus was observed in T_7 (114.28%) followed by T_{11} (107.14%). While as, the minimum increase was shown by T_2 (35.71 %) respectively over control. These results are in agreement to the findings of (Sree-Mannarayana,

1998) who noted that the N and S application has increased the phosphorus content of plants.

Table 1. Effect of F.Y.M, Sewage sludge, N.P.K, Zn and Sulphur on phenol, chlorophyll, protein, sulphur, nitrogen, phosphorus and potassium content in tomato plants.

Treatments	Phenol (mg/100 g)	Chlorophyll (mg/100 g)	Protein (%)	Sulphur (%)	Nitrogen (%)	Potassium (%)	Phosphorus (%)
M_0 **(T_0)** (control)	0.65	1.44	8.12	0.14	1.30	1.40	0.14
S_2 **(T_1)** (Sulphur)	0.75 (15.38)	3.03 (110.41)	8.68 (6.89)	0.19 (35.71)	1.39 (6.92)	1.43 (2.14)	0.21 (50)
Z_1 **(T_2)** (Zinc)	0.73 (12.30)	3.32 (130.55)	8.43 (3.81)	0.15 (7.14)	1.35 (3.84)	1.42 (1.42)	0.19 (35.71)
N_1 **(T_3)** (N.P.K)	0.77 (18.46)	2.26 (56.94)	10.53 (29.67)	0.18 (28.57)	1.68 (29.23)	1.61 (15)	0.25 (78.57)
S_1 **(T_4)** (Sewage sludge)	0.89 (36.92)	2.11 (46.52)	9.58 (17.98)	0.17 (21.42)	1.53 (17.69)	1.57 (12.14)	0.21 (50)
S_1 S_2 **(T_5)** (Sewage sludge + sulphur)	0.94 (44.61)	2.84 (97.22)	9.79 (20.56)	0.21 (50)	1.56 (20)	1.61 (15)	0.23 (64.28)
S_1 Z_2 **(T_6)** (Sewage sludge + zinc)	0.86 (32.30)	3.37 (134.02)	9.75 (18.62)	0.16 (14.28)	1.56 (20)	1.62 (15.71)	0.21 (50)
S_1 N_2 **(T_7)** (Sewage sludge + N.P.K)	1.20 (84.61)	3.56 (147.22)	11.76 (44.82)	0.18 (28.57)	1.88 (44.61)	2.05 (46.42)	0.30 (114.28)
F_1 **(T_8)** (F.Y.M)	0.87 (33.84)	2.69 (86.80)	9.31 (14.65)	0.16 (14.28)	1.49 (14.61)	1.57 (12.14)	0.23 (64.28)
F_1S_2 **(T_9)** (F.Y.M + sulphur)	0.69 (6.15)	2.55 (77.08)	9.62 (18.47)	0.20 (42.85)	1.54 (18.46)	1.61 (15)	0.22 (57.14)
F_1 Z_2 **(T_{10})** (F.Y.M + zinc)	0.84 (29.23)	2.88 (100)	9.49 (16.87)	0.16 (14.28)	1.52 (16.92)	1.63 (16.42)	0.22 (57.14)
F_1 N_1 **(T_{11})** (F. Y.M + N.P.K)	1.05 (61.53)	2.30 (59.72)	11.64 (43.34)	0.17 (21.42)	1.86 (43.07)	1.91 (36.42)	0.29 (107.14)
C.D (P=0.05)	**0.138**	**1.166**	**0.133**	**0.014**	**0.021**	**0.098**	**0.028**

Conclusion

Based on the above results, it is concluded that the application of organic manures along with inorganic fertilizers was found more beneficial and improved biochemical constituents in the tomato. Hence, it is advisable for farmers to use above one in combination form. But, further more studies are needed. Plus, chemical fertilizers must be integrated with organic manures such as, FYM, crop residues and green manures which are renewable and eco friendly and minimizes deleterious effects of chemical fertilizers on soil health and environment. Because, all living things, whether plants or animals, whether living on land or in the water or trees, are affected either directly or indirectly by chemical fertilizers. We, as individuals, can take several steps to alleviate the effects of this problem.

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