

Evaluation of Growth and Reproductive Parameters of Tomato Plant (*Solanum Lycopersicum L.*) For Application of Organic and Inorganic Fertilizers

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ABSTRACT

Reproductive biology provides information on life forms like rate of flowering, type of breeding system, plant-pollinators interaction, fruit and seed output, overall fitness and survival of the species. Present work has been focused to determine the effects of synthetic and organic fertilizers application on the growth parameters like stage of plant development, plant height, number of leaves, number of flowers, flowers to fruits conversion and %yield. Field experiments were conducted in the farms located in Jahangirabad area of Surat city from 2017 to 2018. Season for experiments was chosen between month of October to April where average low temperature of Surat ranges between 15°C-21°C and average high temperature ranges between 25°C-35°C. The treatments consisted of two different fertilizers namely synthetic inorganic fertilizer (SFT) consisting of NPK and organic fertilizer (OFT) chiefly consisting of cow-dung/buffalo-dung/poultry manure. Three plot of 30 x 02 sq. ft area was selected to grow 30 plants of Tomato. One plot was designated as Control group where no pre-treatment (CT group), one plot treated with SFT group and the other with OFT group. Results suggest that OFT treated plant showed increased plant height, quantity of leaves (per branch & plant) and its weight (fresh & dry), quantity of flowers and fruits, diameter and length of fruit, quantity and weight of seed per fruit, nutrition of fruit as compared to Control group and well comparable with SFT treatment. Thus, it is concluded that use of organic fertilizer is equally beneficial as compared to the inorganic fertilizer.

Keyword: Reproductive, Fertilizer, Organic, Inorganic, Tomato

I. INTRODUCTION

Tomato is one of the most important vegetable crops in the world. It belongs to the family Solanaceae, genus *Lycopersicon*, which is relatively small genus

within the large and diverse family consisting of approximately 90 genera. It is consumed fresh and/or as paste in all parts of the world.(Alofe CO, 1982). About 160 million tonnes of fresh tomatoes are produced from 4.7 million ha (Faostat, 2011) wherein

India, 8.82 lakh hectares area is under tomato crop with a total production of 18.73 million tonnes, average productivity 21.2 tonnes/ha (Anonymous, 2015). The cultivated tomato, *Solanum lycopersicum*, is grown for its popular fleshy fruits and is known by different names worldwide like tomate (German), tomaatti (Finish), pomodoro (Italian), kamalis (Malay), jitomate (Spanish), pomidor (Russian) and tamatar (Hindi). (Linnaeus C, 1753) classified tomatoes in the genus *Solanum* and described *S. lycopersicum* (the cultivated tomato) and *Speruvianum*. The very next year (Miller P, 1754) followed (Tournefort, 1694) and formally described the genus *Lycopersicon*. Tomato plays a vital role in the improvement of the diet of mankind and more than 90% of the vitamin C in human diets is supplied by fruits and vegetables (of which tomato is the most important) (Vallejo F et al, 2002). Tomato fruits contain high amount of ascorbic acid and lycopene (Tindall HD, 1983). The present day farming totally depends on use of chemical based fertilizers, pesticides and growth regulators for enhancing crop productivity. In view of various soil and ecological issues, it is needed to reconsider the alternative to chemical agriculture.

It is a well documented that increased dependence on agro-chemicals including fertilizers has led to several ill effects on the environment.

Organic farming is a production system which avoids or largely excludes the use of synthetically produced fertilizers, pesticides, growth regulators and livestock feed additives (Narayan S et al, 2008). Present study focused to determine the effects of inorganic and organic fertilizers application on tomato plant by monitoring and evaluation of parameters like growth stage in plant development, plant height, number of leaves per branch as well as per plant, number of flowers and fruit per plant, diameter, length, weight (fresh & dry) of fruit, number of fruit seed and its weight etc. (Nelson DW, 1996)

II. MATERIAL AND METHOD

Study area: Field experiments were conducted in the farms located in Jahangirabad area of Surat city from 2017 to 2018. Three plots of 30 x 02 sq. ft. area were selected. Soil of selected plots was tested for pH, Electrical conductivity, TOC, N, P, and K before the study started.

Study period: Season for experiments was chosen between month of October to April where average low temperature of Surat ranges from 15°C - 21°C and average high temperature ranges from 25°C - 35°C.

Study design: Seeds of Tomato were purchased from private seed companies located in city Surat. 90 plants of Tomato were planted across the study area. 30 Tomato plants were grown in each plot wherein one plot was designated as control group, second plot for synthetic fertilizer viz. NPK fertilizer (SFT) and third plot for organic fertilizer (OFT) respectively. Spacing between two plants was kept 30 x 30 cm. Soil of control group plot was kept without any treatment of fertilizer and labelled as CT (control for Tomato) whereas in other two plot, pre-conditioning of soil was done with synthetic inorganic fertilizer (SFT) and organic fertilizer (OFT) before 10 days of sowing seedlings which were labelled as SFT (synthetic fertilizer for Tomato) and OFT (organic fertilizer for Tomato) respectively. Next treatment with- OFT and SFT was scheduled after the setting of first flowering to the treatment groups. Irrigation was done every six days after a plant attain the height of approximately 15 cm.

Pest control: For controlling the pests, organo-phosphorus based pesticides was used for spraying SFT plots while organic herbal-based pesticides were made for spraying OFT plots.

Data monitoring and recording: Two parameters viz. Growth parameters and Reproductive parameters were monitored and recorded during the study and are tabulated as below;

1.	Number of leaves per branch	10.	Number of pollens
2.	Number of leaves per plant	11.	Number of fruits per plant
3.	Plant height	12.	Fruit diameter
4.	Average leaf area	13.	Fruit length
5.	Fresh weight of leaves	14.	Fruit weight-fresh
6.	Dry weight of leaves	15.	Fruit weight-dry
7.	Number of flowers per plant	16.	Number of seeds per fruit
8.	Bud bursting	17.	Seed weight in one fruit-dry
9.	Length of stigma	-	--

Parameters from 1 to 6 are growth parameter and evaluated at 15-, 30-, 45- and 60-days. Parameters from 7 to 17 are reproductive parameters and studied from setting of buds till four month of crop time. On-setting of buds to anthesis (bud bursting) was monitored in morning time between 9.00 am to 1.00 pm.

Study of Nutritional Parameters: Addition to above nutritional values of Tomato fruits viz. Protein content (%), Carbohydrate content (%), Sugar content (%), Dietary fibre, Vitamin C and Lycopene were analysed. Protein content (%) was performed by Lowry Method; Carbohydrate content (%) was performed by phenol-sulphuric acid method; Sugar

N (ppm, mg/ml)	P (ppm, mg/ml)	K (ppm, mg/ml)	p H	Conductiv ity (Ω)	TO C (%)
1.05	1.67	2.6	7.8	128.9	1.34

content was measured by Cole's method, dietary fibre (%) and Lycopene content by spectrophotometric method was measured by enzymatic-gravimetric method. Vitamin C content was measured by volumetric analysis (Sadasivam S and Manickam A, 2007) (Mukherjee KS, 2008) (Patel R and Patel K, 2017).

The data were analyzed by the help of statistical Analysis of T-test.

III.RESULTS AND DISCUSSION

The Present study reveal the effect of Synthetic fertilizer and Organic fertilizer application on Tomato crop for growth parameters, reproductive parameters and nutritional parameters studied are discussed below.

Soil analysis:

Before application of fertilizers, soil samples up to 20 cm depth were collected randomly from different parts of the field and analyzed for Physico-chemical properties of soil. After the harvest of the crop the soil samples up to 20 cm were taken from each treatment in each replication and analyzed for Physico-chemical properties of soil and then their average was calculated. The soil analysis was carried out for chemical characters in the laboratory at government science college, Vankal, Gujarat, India and results are tabulated as below:

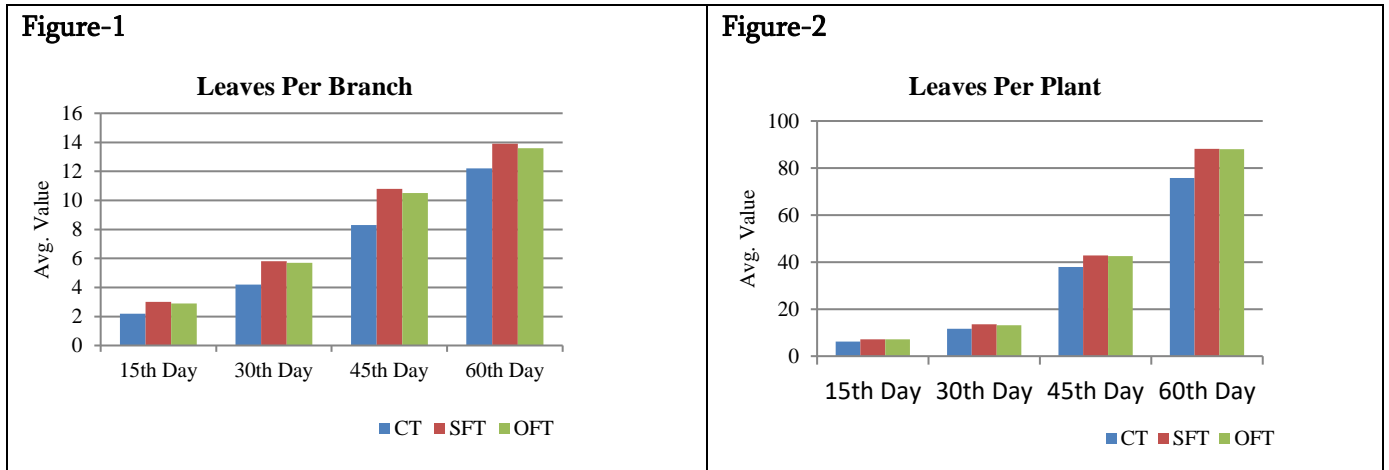
Growth Parameters:

Leaves per branch and leaves per plant

Figure -1 represent "Leaves per Branch" and accordingly numbers of leaves are increased on 60th day in SFT and OFT group as compared to CT group. While comparing the result between SFT and OFT groups, no significant variations is observed in both the group.

Figure -2 represent "Leaves per plant" and accordingly number of leaves per plant of Tomato are almost same

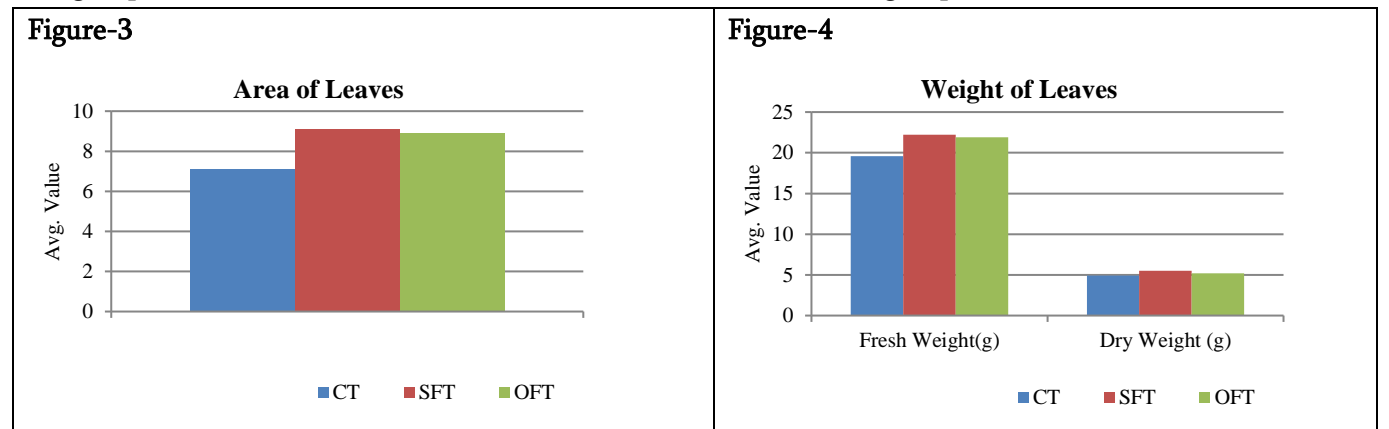
in SFT group and OFT group on 60th day while it was low in CT group.



Area and weight of leaves

According to figure-3, area of leaves are vigour in SFT and OFT group plants as compared to CT group whereas results are well comparable between SFT and OFT group.

Figure-4 represents “Weight of leaves” and accordingly wet weight and dry weight of leaves are significantly increased in SFT and OFT group than CT group whereas results are well comparable between SFT and OFT group.



Plant Height

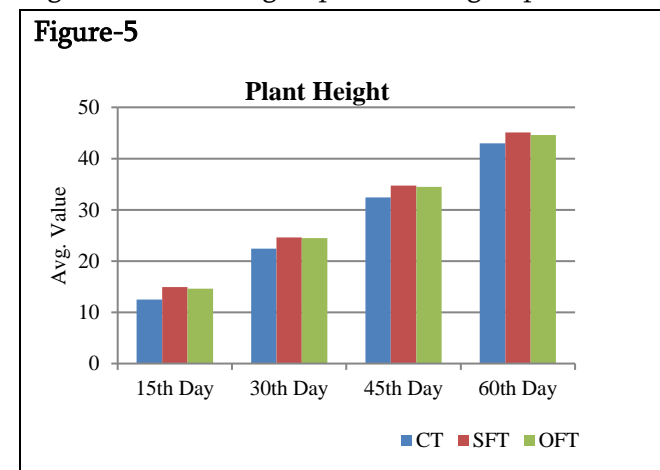
As per figure-5, plant height is significantly increased on 60th day in SFT and OFT group as compared to CT group plants whereas insignificant difference in plant height between SFT group than OFT group.

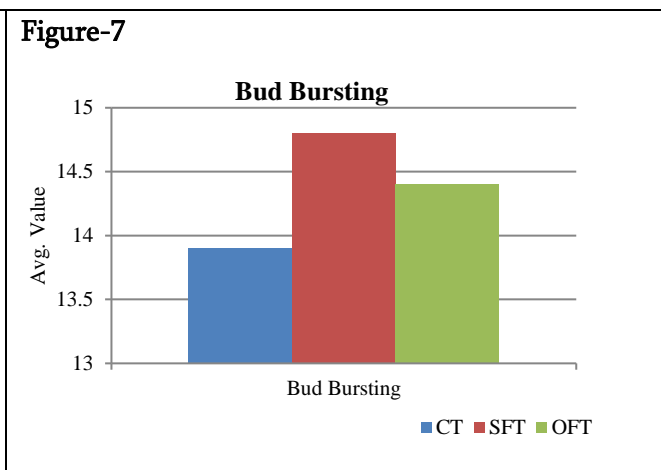
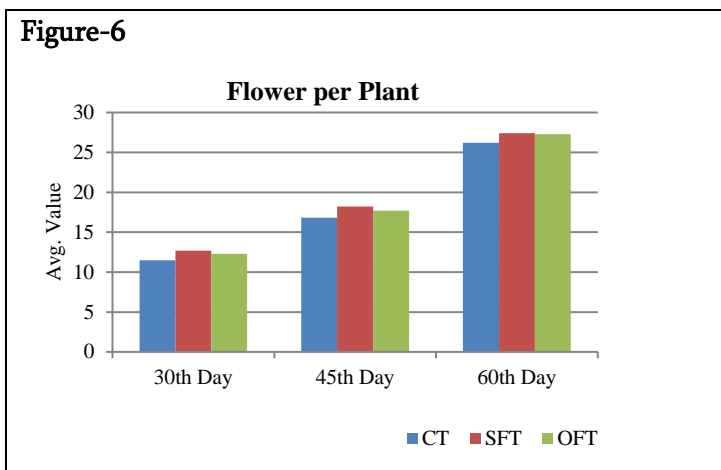
Based on above graphical presentation, there is no significant variation reported in growth parameters between SFT and OFT group and are well comparable; whereas significantly decreased in CT group plants.

Reproductive Parameters:

No. of flower and flower buds

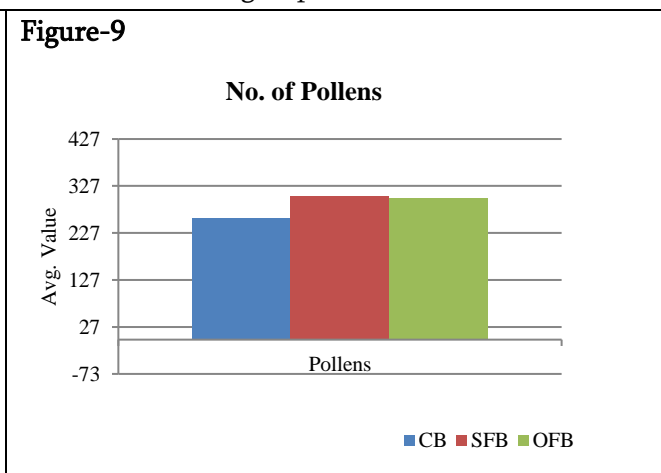
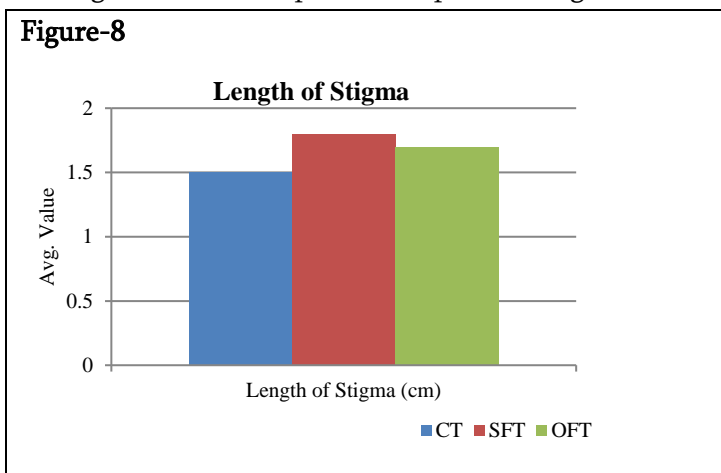
As per figure-6 “No. of flowers” and figure-7 “Bud bursting”, SFT group shows increased amount of flower and flower buds than CT group whereas insignificant increased as compare to OFT group.





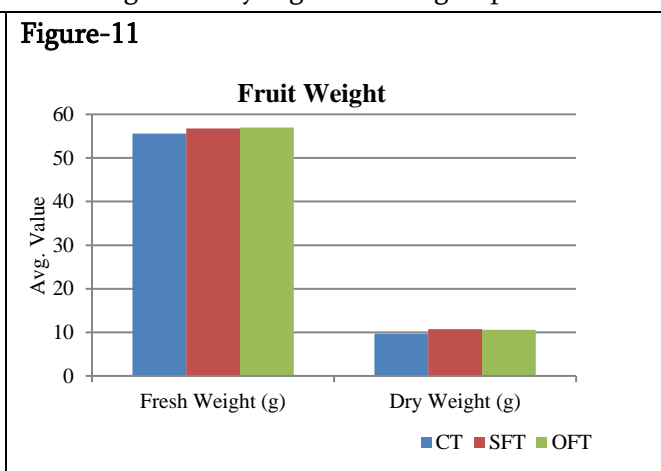
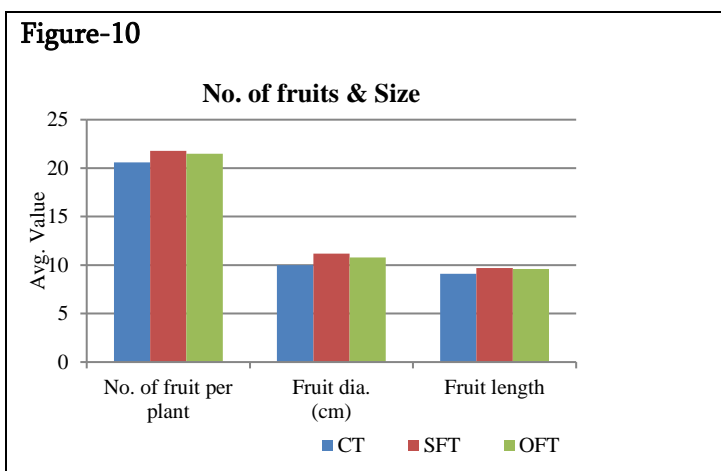
Length of stigma and number of pollens:
Graphical presentation of figure-8 “Length of stigma” and figure-9 “no. of pollens” represents significant

increases in length of stigma and no. of pollens in SFT group as compared to CT group while non-significant increases than OFT group.



Yield of fruits:
According to figure-10 “No. of fruits and fruit size”, number of fruits per plant was better in SFT and OFT group than CT group. Length and diameter of fruits

are also increased in SFT group as compared to CT group whereas non significantly high than OFT group. As per Figure-11 “Fruit Weight”, dry and wet weight of fruit is comparable between SFT and OFT group whereas significantly high than CT group.

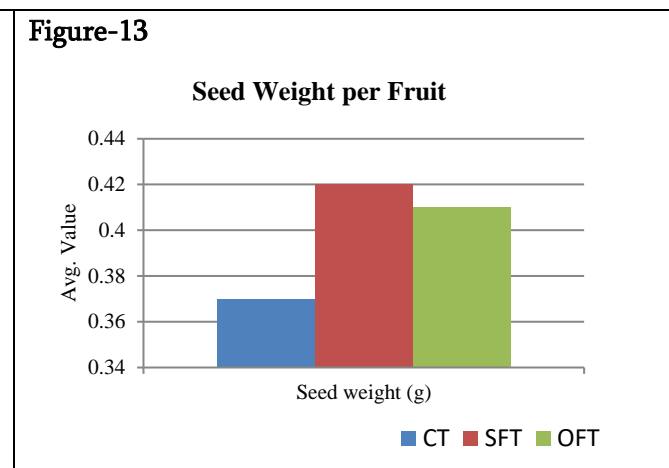
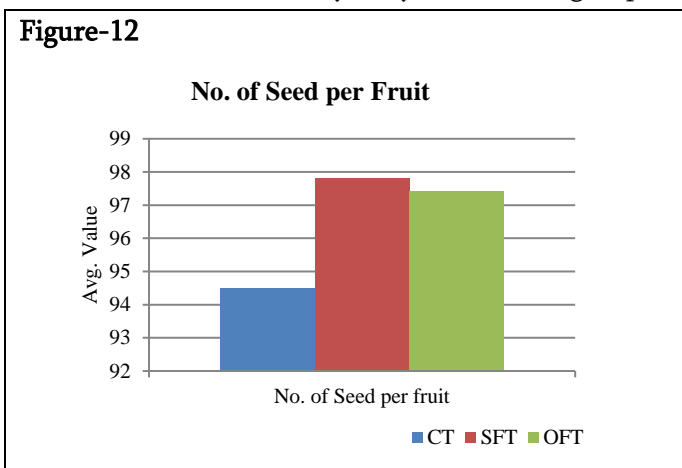


No. of seed and seeds weight per fruit:

As per figure-12 “No. of seeds” and figure-13 “Weight of seeds”, amount and weight of seed were non

significantly high in SFT group than OFT group whereas it was statistically very low in CT group in

comparison to SFT & OFT groups.



Nutritional Parameters:

Study was conducted for nutritional parameters like protein content (%), Carbohydrate content (%), Sugar content (%), Dietary fibre, Vitamin C and Lycopene for all the group of plants of field experiments viz. CT, SFT and OFT groups.

According to table-02, results showed significant increased in the parameters like Dietary fibre, carbohydrate and sugar content in OFT group then CT and SFT groups. There was increase in protein % in SFT group than CT whereas well comparable with OFT group. Vitamin C was non significantly low in CT group compared to SFT & OFT groups.

group whereas non-significantly high than CT group. Hence, organic fertilizer is equally efficient to grow the plants and have equal significance; Organic fertilizer can surrogate the requirement for usage of chemical based synthetic fertilizer.

IV.CONCLUSION

Above result depicts that the fertilizers used during farming has direct effect on growth parameters like no. of leaves, leaf area, inter node length etc. and reproductive parameters as mentioned above. The effect was also seen on biological time of plant i.e., early bud-setting and flower anthesis by the use of organic fertilizers on Tomato. Organic fertilizer also showed good results in nutritive value of the crops and yield of crops as well when compared to inorganic fertilizer. Hence, Organic fertilizer plays equal role in growth of Tomato plants as compare to synthetic inorganic fertilizer. It is the matter of research to understand that how fertilizer can affect the genotyping or alters the pheno typing of genes for flowering.

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Table-02: Results of Nutritional parameters (Average Value per 100g)

Nutritional Parameter	CT	SFT	OFT
Dietary fibre (g)	1.16	1.18	1.24
Carbohydrate (g)	2.82	2.95	3.10
Sugar (g)	2.46	2.50	2.56
Protein (g)	0.84	0.86	0.88
Vitamin C (mg)	18.10	19.04	20.38
Lycopene (mg)	2.58	2.69	2.87

Above field experiments result represents that the growth and reproductive parameter of tomato plants were increased and well comparable in SFT and OFT group than controlled group (CT) which did not pre-treated with any additional supplement (fertilizer treatment) during the study. Also the nutritional parameter are well comparable between OFT and SFT

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VI. REFERENCES

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