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Evaluation of Crop Varieties and Fertilizers Doses on Growth, Yield and Quality of Cherry Tomato Grown under Protected Condition

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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 study titled "Evaluation of varieties and fertilizers doses on growth, yield and quality of cherry tomato grown under protected condition" was conducted in 2021-2022 season at the Department of Horticulture, Naini Agricultural Institute, Sam Higginbottom University of Agriculture Technology and Sciences, Prayagraj, Uttar Pradesh during the Rabi-2021-22 with the objective to determine the effect of fertilizer application of micronutrients on cherry tomato variety Pusa cherry, Ngamoti and Roja Red for their growth, fruit quality and yield and to work out the economics of various treatments. There were twelve treatments with T1 (Pusa Cherry -1 (RDF@30+10+40 kg/1000m²) as control, T2 Pusa Cherry -1 @ 30+7+35 kg/1000m2, T3Pusa Cherry -1 @ 35+12+40 kg/1000m2, T4Pusa Cherry -1 @ 40+17+45 kg/1000m2, T5Nagmoti (RDF@30+10+40 kg/1000m²) , T6Nagmoti

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@ 30+7+35 kg/1000m2, T7Nagmoti @ 35+12+40 kg/1000m2, T8Nagmoti @ 40+17+45 kg/1000m2, T9 Roja Red (RDF@30+10+40 kg/1000m²), T10 Roja Red @ 30+7+35 kg/1000m2, T11 Roja Red @ 35+12+40 kg/1000m2 and T12 Roja Red @ 40+17+45 kg/1000m2. Treatment T4 (Pusa Cherry -1 @ 40+17+45 kg/1000m2) out performed the rest of the treatments in all parameters of growth, yield and quality and net return ofT4 with Rs. 4,07,800 and the highest B:C ratio of 1:6.7.

Keywords: Yield; growth parameter; quality; var. of cherry tomato; benefit cost ratio.

1. INTRODUCTION

"The cherry tomato is believed to be the direct ancestor of modern cultivated cherry tomatoes and is the only wild cherry tomato found outside South America. The cherry tomato is thought to have been first domesticated in the Puebla-Veracruz area of Mexico and to have reached this area from South America in the form of a weedy cherry tomato. Cherry tomato (*Solanum lycopersicum var cerasiforme* L.) is gaining popularity as an integral component of salad in and around the globe. It has nutraceutical potential, contained vitamin 'A' and 'C' and minerals (K, P, Mg and Ca) photo-chemicals (lycopene). Lycopene has an antioxidant role, which minimizes the risk cancer, prostate adenocarcinoma and cardiovascular diseases in humans" [1].

"Cherry tomato is a smaller garden variety of cherry tomato. It is a warm-season crop. The crop does well under an average monthly temperature of 210C to 230C. Temperature and light intensity affect the fruit-set, pigmentation and nutritive value of the fruit. Cherry tomatoes range in size from a thumb tip up to the size of a golf ball, and can range from being spherical to slightly oblong in shape. The cherry tomato is regarded as a botanical variety of the cultivated cherry tomato, *Solanum lycopersicum* var. cerasiforme Or *Lycopersicon esculentum* var. cerasiforme. Cherry tomato contains energy-75.4 kJ, water-94.5 gm, protein – 0.9 gm, Fat – 0.2 gm, carbohydrates – 3.9 gm, Calcium – 10 mg, potassium – 237 mg, Vitamin A – 833 IU and Vitamin C – 12.7 mg per 100 gm edible portion" [1].

"In addition to its economic importance, cherry tomato consumption has recently been demonstrated to be beneficial to human health, because of its content of Phyto-chemicals such as lycopene, β-carotene, flavonoids, vitamin C and many essential nutrients" [2]. "This composition explains the high antioxidant capacity in both fresh and processed cherry tomatoes, associating the fruit with lower rates of certain types of cancer and cardiovascular disease" [3].

"In foliar application, nutrients enter through aqueous pores of leaf cuticles, cell wall of the epidermal cells and plasma membrane by active transport" [4]. "Micronutrients have an important role in the plant activities and foliar application can improve the vegetative growth, fruit set and yield of cherry tomato [5] by increasing photosynthesis of green plants". "Among micronutrients, Zn and B are important for plant nutrition. Cherry tomato requires both major and micronutrients for its proper plant growth" [6]. "Zn plays important role on growth and development as well as carbohydrates, protein metabolism and sexual fertilization of plant [7] while B deficiency reduced yield and quality in cherry tomatoes". "Balanced fertilization of macro and micronutrients can increases production but foliar application of micronutrients is the not only efficient but also secured way" [8]. Keeping in view the importance of micronutrients, the present study was initiated to find out the effect of Zn and B as foliar application on the growth, quality and yield of cherry tomato.

In NPK fertilizer, nitrogen is the most important major essential plant nutrient, important constituent of proteins and amino acids in chief constituent of chlorophyll controls the utilization of nutrient like P & K formation of protein and nucleic acid in phosphorus (P) is essential for enzyme and energy transfer reactions of nucleic acids protein synthesis cell membrane component of cell division in ripening process of phosphorus. Potassium (K) is an enzyme activator essential for protein synthesis stomatal functions turgor potential, free agent in plants that helps in photosynthesis, fruit formation, developing winter hardiness and disease resistant for sugar translocation.

AGROMIN provides essential plant nutrients such as Zinc, Iron, Copper, Manganese, Magnesium in partially chelated form and Boron and Molybdenum in ideal predetermined productions and its prevents and corrects traced

element deficiency from the onset. If any of these nutrients are in short supply, the crop fails to utilize the major nutrient fertilizer due to lack of balanced proportion. Agromin increases the crop yield by correcting micro nutrient deficiencies and ensuring better nutrient balance. Agromin is a most effective source of micro elements for all crops Agromin has been formulated by Aries by using the various state specific formulations as notified by various state Governments.

2. MATERIALS AND METHODS

The present investigation was carried out during 2021-22 on crop research farm of Department of Horticulture, Naini Agricultural Institute, Prayagraj, India. The area is situated on the south of Prayagraj the right side of the river Yamuna on the South of Rewa road at a distance of about 6 km from Allahabad city. It is situated at 25024'23" N latitude, 81050'38" E longitude and at an altitude of 98 meter above mean sea level (MSL).

Soil samples were collected from the multiple locations both conventional and organic experimental plot using soil auger before land preparation and after the harvesting of crop. These soil samples were properly labeled and brought to the laboratory. The samples were dried thoroughly in shade, pulverized and sieved through 2 mm mesh sieve thoroughly mixed to make it composite sample. These samples were then kept in properly marked polythene packets, appropriately sealed, and stored for different experiments during the course of investigation.

The experiment was laid out in Factorial Randomized Block Design. The treatment comprised of 3 levels of organic inputs. There were 9 treatments randomly arranged in each replication, divided into twenty-seven plots. Observations on growth parameters, yield and quality characters of cherry tomato were recorded for the conventional and organic plots by tagging five randomly selected plants and their average values were worked out. The observations were recorded at regular intervals of 15,30,45 and 60 days.

The data recorded for different characteristics were subjected to statistical analysis by adopting the method of analysis of variance (ANOVA) as described by Gomez and Gomez (1984). The significance of comparison was tested. The significant difference values were computed for 5 percent probability of error. Wherever the variance ratio (F value) was found significant, critical difference (CD) values were computed for the comparison among the treatment means.

3. RESULTS AND DISCUSSION

Data on the growth characters, yield attributes and yield and quality parameters of the experimental field as affected by different fertilizer applied to cherry tomato were recorded at their respective stages (30, 60, 90DAS and at harvest). Economic analyses of the cherry tomato were also worked out.

3.1 Plant Height

The combined effects due to different planting date and different doses of fertilizer and their interaction on the growth, yield and yield contributing characters have been presented under the following headings.

As revealed by the data, plant height was increased with increasing days from sowing to harvest and the maximum increment was noticed between 60 to 90 DAS.

Although the analysis of plant height was found to be statistically non-significant from sowing to 30 days, but there was a significant increase in the plant height from 30 to 90 days due to different treatments.

At 30 DAS, non significantly higher value of plant height (61.36 cm) was recorded with the treatment V1F3 with V1 Pusa Cherry -1@ 40+17+45 kg/1000m^2. Non significantly lower plant height (36.21 cm) was recorded with the variety of little marvel and with the different treatment of cherry tomato. All the treatments have one single control sample with no fertilizer and value of the treatment 50.51, 37.21 and 36.51 cm.

At 60 DAS, significantly higher value of plant height (91.00 cm) was recorded with the treatment V1F3 with V1 Pusa Cherry -1@ 40+17+45 kg/1000 m^2. Significantly lower plant height (77.09 cm) was recorded with the variety of little marvel and with the different treatment of cherry tomato. All the treatments have one single control sample with no fertilizer and value of the treatment 79.39, 80.73 and 77.09 cm.

At 90 DAS, significantly higher value of plant height (142.18 cm) was recorded with the treatment V1F3 with different fertilizer and

different variety of cherry tomato. Significantly lower plant height (132.85 cm) was recorded with the variety of little marvel and with the different treatment of cherry tomato. All the treatment have one single control sample with no fertilizer and value of the treatment 134.61, 136.15 and 132.85 cm.

At harvest, significantly higher value of plant height (143.4 cm) was recorded with the treatment V1F3 with different fertilizer and different variety of cherry tomato. Significantly lower plant height (133.10 cm) was recorded with the the variety of little marvel and with the different treatment of cherry tomato. All the treatment have one single control sample with no fertilizer and value of the treatment 132.34, 132.08 and 133.10 cm.

3.2 Number of Leaves

The number of leaves per plant is an important growth character, which had direct bearing on yield. The data on number of leaves per plant at various growth stages of crop are given in Table 2. It is observed from the data that number of leaves per plant increases considerably up to 30, 60, 90 DAS and at-harvest stage under all treatments and thereafter it was constant. However, at 30 DAS the data recorded was found to be non-significant for all the treatment with different fertilizer doses and control sample.

Table 1. Effect of different levels of fertilizer on plant height of different variety of cherry tomato

Treatment of symbol	Plants height (cm)			
	30 DAS	60 DAS	90 DAS	At harvest
V1F0	50.51	79.39	134.61	132.34
V1F1	57.84	83.82	136.96	136.25
V1F2	58.88	84.8	139.88	137.78
V1F3	**61.36**	**91.99**	**142.18**	**143.4**
V2F0	37.21	80.73	136.15	132.08
V2F1	47.49	85.6	137.16	134.58
V2F2	53.92	86.11	139.77	140.01
V2F3	55.82	82.45	140.92	141.37
V3F0	**36.51**	**77.09**	**132.85**	**130.1**
V3F1	45.23	80.91	136.89	132.6
V3F2	48.28	81.34	139.76	134.6
V3F3	52.21	83.56	140.28	137.2
F-test	**S**	**S**	**S**	**S**
S.Em. (+)	**3.65**	**5.93**	**8.39**	**11.3**
C.D. at 0.5%	**7.9**	**8.23**	**8.62**	**9.3**
C.V	**8.20**	**5.84**	**8.73**	**7.58**

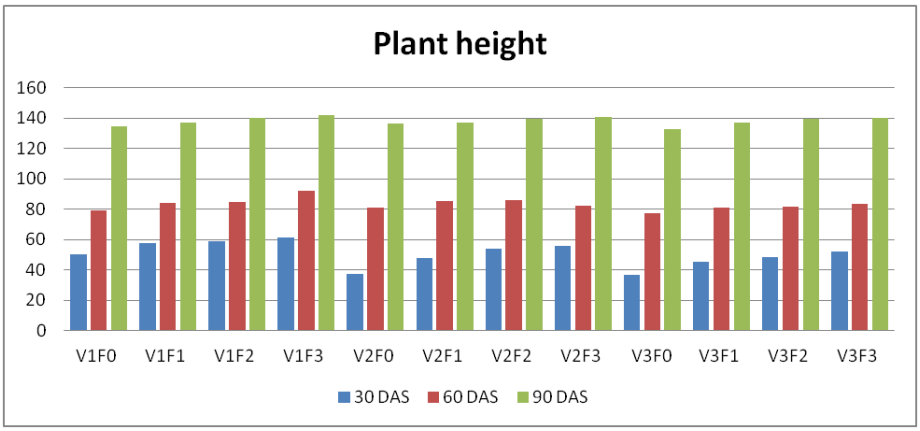

Fig. 1. Effect of different levels of fertilizer on plant height of different variety of cherry tomato

The analysis of leaves per plant was found to be statistically non-significant due to different treatments. The branches per plant increased slowly since 60 DAS which soared to the highest at harvest of the crop in all the treatments. Effect of treatments on crop growth rate at 30 DAS was non-significant. However at 60, 90 DAS and At harvest, cherry crop growth rate was significantly affected due to different treatments.

At 60 DAS, significantly higher value of plant height (43.05) was recorded with the treatment V1F3 with different fertilizer and different variety of cherry tomato. Significantly lower plant height (36.66) was recorded with the variety of Nagmoti and with the different treatment of cherry tomato. All the treatment have one single control sample with no fertilizer and value of the treatment 38.72, 37.77 and 34.55 cm.

At harvest, significantly higher value of plant height (56.89) was recorded with the treatmentV1F3 with different fertilizer and different variety of cherry tomato. Significantly lower plant height (48.75) was recorded with the variety of nagmoti and with the different treatment of NPK of cherry tomato. All the treatment have one single control sample with no fertilizer and value of the treatment 50.72, 48.75 and 49.98 cm.

Table 2. Effect of different levels of fertilizer on of leaves per plant of different variety of cherry tomato

Treatment of symbol	No of leaves per plant			
	30 das	40 DAS	60 DAS	At harvest
V1F0	13.79	21.99	38.72	50.72
V1F1	14.99	23.93	39.78	51.52
V1F2	16.74	24.14	41.22	54.51
V1F3	**17.41**	**26.76**	**43.05**	**56.89**
V2F0	**11.28**	**20.67**	**36.66**	**48.75**
V2F1	12.74	23.05	37.77	49.14
V2F2	12.76	24.21	38.24	51.15
V2F3	14.40	25.16	41.11	52.20
V3F0	12.64	20.23	34.55	49.98
V3F1	13.25	22.98	36.29	50.82
V3F2	15.04	24.23	38.62	52.06
V3F3	16.23	25.54	40.32	54.37
F-test	S	S	S	S
S.Em. (+)	**0.55**	**1.18**	**1.53**	**0.67**
C.D. at 0.5%	**1.66**	**3.55**	**2.39**	**1.65**
C.V	**1.27**	**1.57**	**1.86**	**1.84**

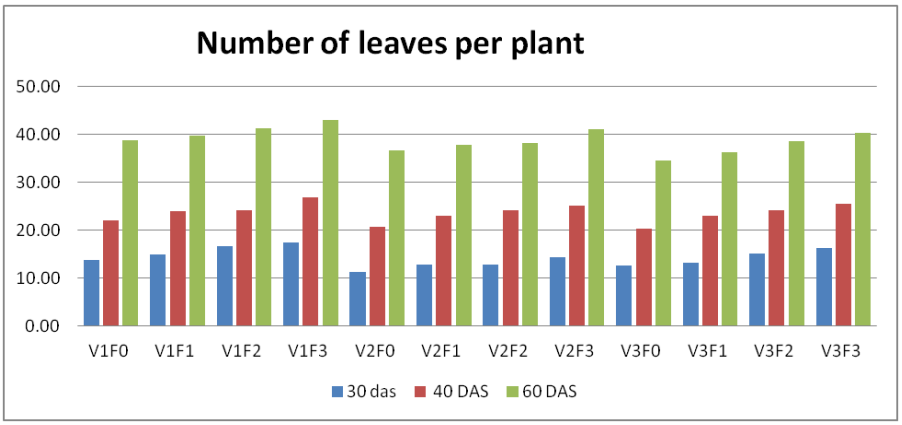

Fig. 2. Effect of different levels of fertilizer on no of leaves per plant of different variety of cherry tomato

3.3 Number of Branch Per Plant

Although the analysis of number of branches per plant was found to be statistically non-significant from sowing to 30 days, but there was a significant increase in the number of branches from 30 to 90 days due to different treatments. The number of branch per plant increased slowly till 90 DAS which soared to the highest at harvest of the crop in all the treatments.

At harvest, number of branches per plant significantly increased, the higher value (15.11) was recorded with the treatment V1F3 with different fertilizer and different variety of cherry tomato. Significantly lower of number of branches per plant (9.61) was recorded with the the variety of nagmoti and with the different treatment of cherry tomato. All the treatment have one single control sample with no fertilizer and value of the treatment 13.86, 13.33 and 12.89.

3.4 Number of Flower Per Cluster

At harvest, Number of flower per cluster per plant significantly higher value of (12.24) was recorded with the treatment V1F3 with different fertilizer and different variety of cherry tomato. Significantly lower of number of cluster per plant (8.56) was recorded with the variety of little marvel and with the different treatment of cherry tomato. All the treatment have one single control sample with no fertilizer and value of the treatment 11.71, 11.47 and 11.24.

3.5 Number of Fruit Per Cluster

At harvest, Number of fruits per cluster per plant significantly higher value of (46.29) was recorded with the treatment V1F3 with different fertilizer and different variety of cherry tomato. Significantly lower of number of cluster per plant (37.41) was recorded with the variety of little marvel and with the different treatment of cherry tomato. All the treatment have one single control sample with no fertilizer and value of the treatment 43.94. 43.12 and 42.74.

3.6 Number of Cluster Per Plant

At harvest, Number of cluster per plant significantly higher value of (14.14) was recorded with the treatment V1F3 with different fertilizer and different variety of cherry tomato. Significantly lower of number of cluster per plant (9.12) was recorded with the variety of little marvel and with the different treatment of cherry tomato. All the treatment have one single control sample with no fertilizer and value of the treatment 9.92. 9.31 and 9.12.

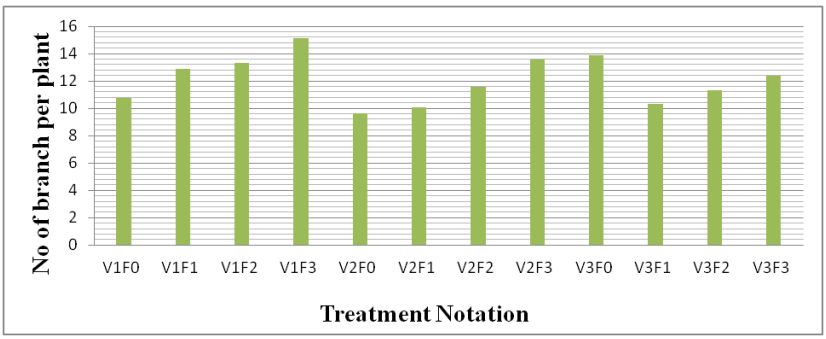

Fig. 3. Effect of different levels of fertilizer on no of branches per plant of different variety of cherry tomato

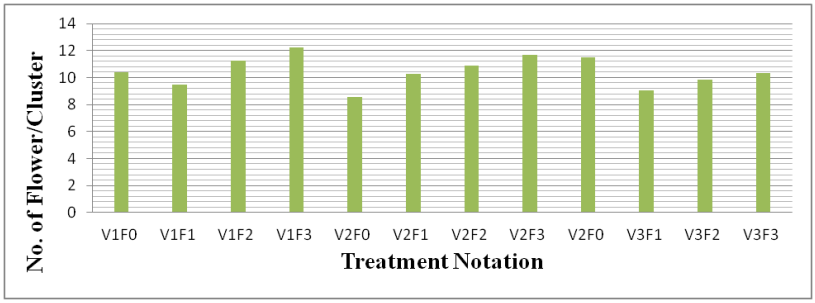

Fig. 4. Effect of fertilizer doses on number of flower per cluster of cherry tomato

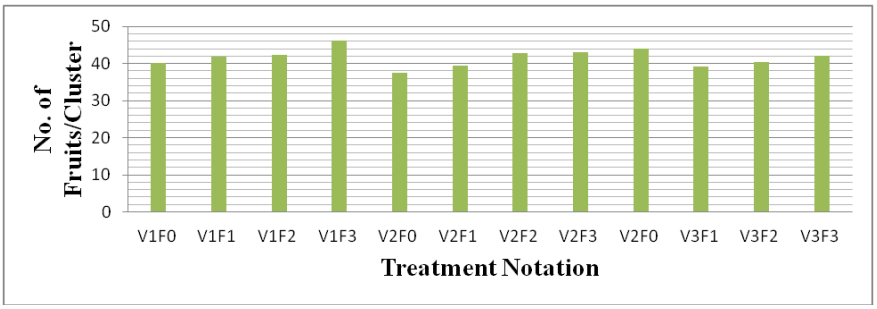

Fig. 5. Effect of fertilizer doses on number of fruits per cluster of cherry tomato

Table 3. Effect of different levels of fertilizer on no of branch per plant of different variety of cherry tomato

Treatment of symbol	No of branch per plant	No. of flower/CLUSTER	No. of fruits/cluster
V1F0	10.77	10.4	40.12
V1F1	12.89	9.48	41.78
V1F2	13.33	11.24	42.37
V1F3	**15.11**	**12.24**	**46.29**
V2F0	**9.61**	**8.56**	**37.41**
V2F1	10.09	10.26	39.44
V2F2	11.55	10.86	42.74
V2F3	13.57	11.71	43.12
V3F0	13.86	11.47	43.94
V3F1	10.33	9.07	39.28
V3F2	11.34	9.87	40.44
V3F3	12.4	10.35	41.97
MEAN	**9.34**	**8.11**	**12.31**
F-test	S	S	S
S.Em. (+)	**0.55**	**1.18**	**1.53**
C.D. at 0.5%	**1.66**	**3.55**	**2.39**

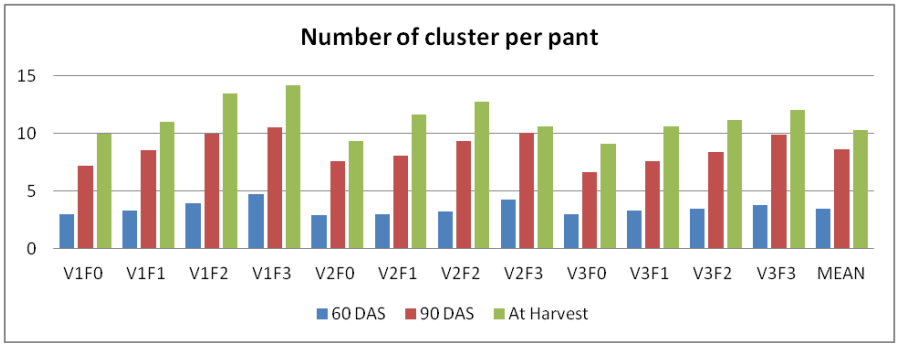

Fig. 6. Effect of different levels of fertilizer on no of cluster per plant of different variety of cherry tomato

Table 4. Effect of different levels of fertilizer on number of cluster per plant of different variety of cherry tomato

Treatment of symbol	No of cluster per plant		
	60 DAS	**90 DAS**	**At harvest**
V1F0	2.97	7.15	9.92
V1F1	3.25	8.54	10.97

Treatment of symbol	No of cluster per plant		
	60 DAS	90 DAS	At harvest
V1F2	3.96	9.94	13.42
V1F3	**4.75**	**10.55**	**14.14**
V2F0	**2.91**	**7.55**	**9.31**
V2F1	2.93	8.04	11.66
V2F2	3.17	9.34	12.72
V2F3	4.22	10.01	10.59
V3F0	2.95	**6.65**	**9.12**
V3F1	3.25	7.56	10.56
V3F2	3.45	8.34	11.11
V3F3	3.78	9.9	12.04
F-test	S	S	S
S.Em. (+)	**0.32**	**0.44**	**0.22**
C.D. at 0.5%	**0.96**	**1.32**	**0.65**
C.V	**0.46**	**0.6**	**0.29**

3.7 Days to 1st Flowering

Data pertaining to the effect of fertilizer on Days to 1st Flowering of cherry type of cherry tomato has been presented in Table 5 and Fig. 5. Thorough examination of data revealed that fertilizer had significant effect on Days to 1st Flowering of cherry tomato during the study. Interaction between different planting time and fertilizer levels on number of flowers per plant was found to be statistically significant. The highest Days to 1st Flowering at harvest with treatmentV1F3 (53.61) when oppositely the lowestDays to 1st Flowering with treatment V2F2 (52.11) was found in all the treatment.

3.7.1 Days to 50% flowering

At 90 DAS, Number of Days to 50 % flowering-plant recorded a significantly higher value of (69.56) with the treatment V1F3 with V1 Pusa Cherry -1@ 40+17+45 kg/1000m^2. Significantly lower of Days to 50 % Flowering plant (63.17) was recorded with the variety of nagmoti and with the different treatment of cherry tomato.

3.7.2 First fruit setting (DAT)

At-harvest, First Fruit Setting of plant recorded significantly higher value of (68.56) with the treatment V1F3 with V1 Pusa Cherry -1@ 40+17+45 kg/1000m^2. Significantly lower of First Fruit Setting (DAT) plant (54.89) was recorded with the variety of nagmoti and with the different treatment of cherry tomato. All the treatment have one single control sample with no fertilizer and value of the treatment 64.22, 62.75and 60.39.

3.8 Number of Fruit Per Plant

The combined effect between different planting time and fertilizer doses on the number of flowers per plant was significant. The total number of fruit per plant ranged from 75.31 to 88.22. It is evident from the results shown in that the highest number of fruit per plant (88.22) was recorded in 90 DAS planting with different combination of fertilizer. The lowest number of fruit per plant (75.31) was observed in V2F0 treatment.

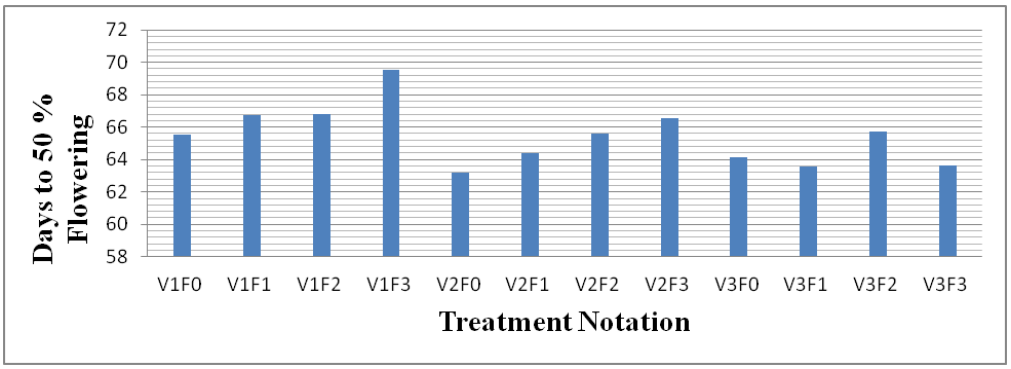

Fig. 7. Days to 50% flowering

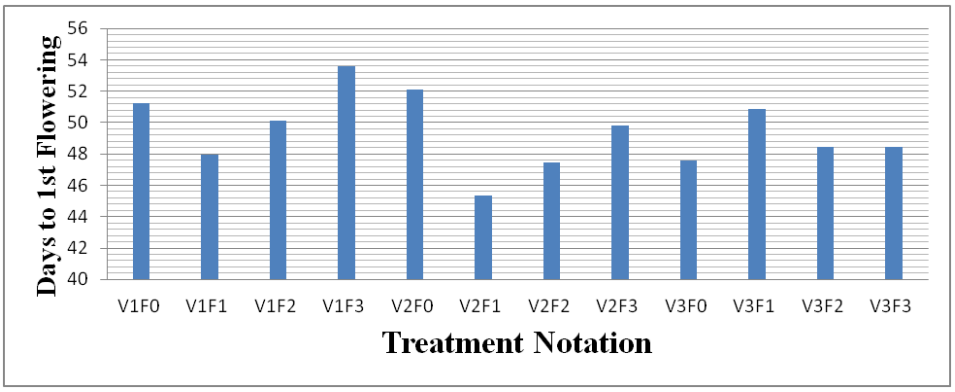

Fig. 8. Days to 1st flowering and first fruit setting

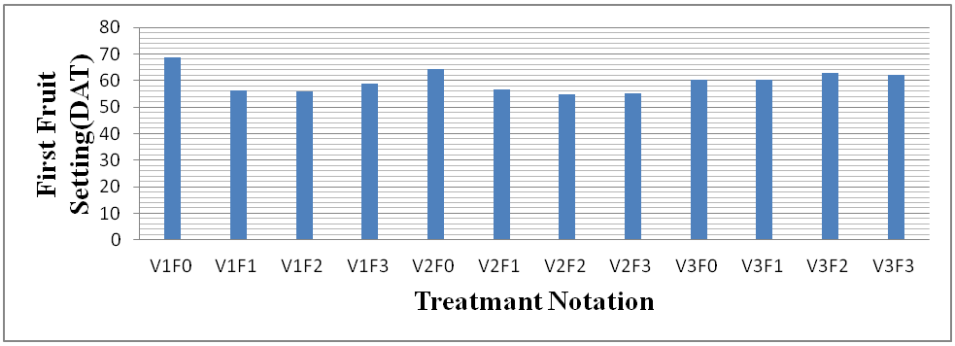

Fig. 9. Figure of Days to 1st flowering and first fruit setting

Table 5. Effects of fertilizers on days to first flowering, Days to 50% flowering and first fruit setting (DAT) of cherry tomato

Sr.	Treatment	Days to 1st flowering	Days to 50% flowering	First fruit setting(DAT)
T1	V1F0	51.22	65.56	68.56
T2	V1F1	47.94	66.75	56.28
T3	V1F2	50.11	66.80	55.97
T4	V1F3	53.61	69.56	58.81
T5	V2F0	52.11	63.17	64.22
T6	V2F1	45.36	64.42	56.69
T7	V2F2	47.47	65.61	54.89
T8	V2F3	49.83	66.53	55.11
T9	V2F0	47.56	64.11	60.31
T10	V3F1	50.86	63.56	60.39
T11	V3F2	48.47	65.75	62.75
T12	V3F3	48.44	63.61	62
F-test		**S**	**S**	**S**
S.Ed (±)		**0.68**	**0.59**	**0.92**
C.D. @ 5 %		**1.41**	**1.23**	**1.98**
C.V.		**1.69**	**1.12**	**2.14**

At harvest the combined effect between different planting time and fertilizer doses on the number of fruits per plant was significant. The highest number of fruits per plant (133.44) was recorded in at harvest with V1F3 treatment. The lowest number of fruits per plant (98.75) was observed in V2F0 treatment.

3.9 Yield and Quality

3.9.1 Fruit diameter

Data pertaining to the effect of fertilizer on fruit diameter of cherry tomato has been presented in Table 7 and Fig. 7. Thorough examination of

data revealed that fertilizer had significant effect on fruit diameter of cherry tomato. Interaction between different planting time and fertilizer levels on fruit diameter was found to be statistically significant. The highest fruit diameter (4.53) when oppositely the lowest fruit diameter (2.36) was found in all the treatment.

During the analysis, maximum fruit diameter of cherry tomato (4.53 cm) were observed with application of (V1F3) which was registered significantly superior to rest of the treatments followed by (V3F1) (3.89 cm). Whereas, treatments control recorded least head diameter of cherry tomato (2.36 cm). However, minimum number of fruit diameter of cherry tomato was found in the treatments control i.e. without fertilizer.

3.9.2 Fruit weight

Data pertaining to the effect of fertilizer on fruit weight of cherry type of cherry tomato has been presented in Table 7 and Fig. 8. Thorough examination of data revealed that fertilizer had significant effect on fruit weight of cherry tomato during the study. Interaction between different planting time and fertilizer levels on fruit weight was found to be statistically significant. The highest fruit weight with treatment V1F3 (12.87 g) when oppositely the lowest fruit weight with treatment V2F2 (8.65 g) was found in all the treatment.

3.9.3 Juiciness

Data pertaining to the effect of fertilizer on juiciness of cherry type of cherry tomato has been presented in Table 7 and Fig. 8. Thorough examination of data revealed that fertilizer had significant effect on fruit juiciness of cherry tomato during the study. Interaction between different planting time and fertilizer levels on fruit juiciness was found to be statistically significant. The highest fruit juiciness with treatment V1F3 (27.27 g) when oppositely the lowest fruit juiciness with treatment V2F2 (20.86 g) was found in all the treatment.

3.9.4 Fruit yield per plot (kg)

There was significant interaction effect between different planting time and fertilizer doses on individual fruit weight yield per plant. The highest individual fruit yeild per plant (3.08 kg) and the lowest individual fruit yield per plant (1.55 kg) was obtained from control plot.

3.9.5 Fruit yield per 1000 m^2

At harvest, fruit yield per hactare significantly, the higher value (69.95 t/ha) was recorded with the treatment V1F3 with different fertilizer and different variety of cherry tomato. Significantly lower of yield (59.92 t/ha) was recorded with the variety of nagmoti and with the different treatment of cherry tomato. All the treatment have one single control sample with no fertilizer and value of the treatment 61.90, 63.20 and 58.14.

3.9.6 Ascorbic acid (Vitamin C)

Data with respect of changes in Vitamin-C content of standardized burfi due to different treatments furnished in Table 7. Vitamin-C content continuously increased due to different variety of cherry tomato and content was found to be significantly reduced.

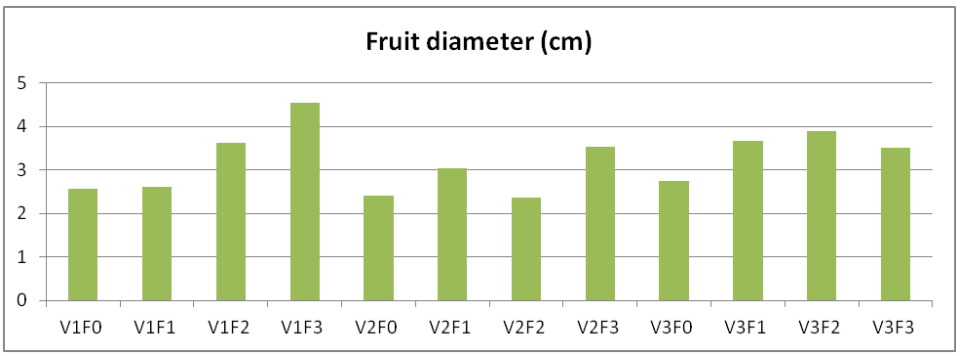

Fig. 10. Effect of different levels of fertilizer on fruit diameter plant of different variety of cherry tomato

Table 6. Effect of different levels of fertilizer on no of fruits per plant of different variety of cherry tomato

Treatment of symbol	No of fruit per plant	
	90 DAS	**At harvest**
V1F0	82.64	102.58
V1F1	84.16	108.81
V1F2	85.77	112.06
V1F3	**88.22**	**133.44**
V2F0	**75.31**	**98.75**
V2F1	76.48	109.11
V2F2	78.98	118.37
V2F3	79.12	125.95
V3F0	79.92	113.44
V3F1	80.56	119.81
V3F2	81.85	125.75
V3F3	82.37	129.44
F-test	**S**	**S**
S.Em. (+)	**1.39**	**1.26**
C.D. at 0.5%	**0.91**	**1.17**
C.V	**0.46**	**0.59**

Table 7. Combined effects of variety and organic manures on growth, yield and quality characters of different variety of cherry tomato

Symbol	Fruit diameter(cm)	Fruit weight (g)	Fruit yield per plant (kg)	Juiciness (%)	Fruit yield per 1000 m2	Total soluble solids (0Brix)	Vitamin C (mg/100g of fruit pulp)
V1F0	2.57	8.91	1.63	**20.86**	61.9	**7.06**	**8.25**
V1F1	2.61	9.85	1.99	22.87	62.84	7.69	8.91
V1F2	3.62	11.51	2.89	25.00	67.96	9.89	11.26
V1F3	**4.53**	**12.87**	**3.08**	**27.27**	**69.95**	**10.1**	**12.1**
V2F0	2.4	10.38	2.27	25.48	63.2	8.94	9.95
V2F1	3.03	10.99	2.35	24.26	63.95	9.69	10.75
V2F2	**2.36**	**8.65**	2.07	24.47	**59.92**	8.59	8.33
V2F3	3.52	12.08	2.7	25.39	66.32	9.95	11.87
V2F0	2.75	8.65	**1.55**	23.23	58.14	8.65	8.55

Symbol	Fruit diameter(cm)	Fruit weight (g)	Fruit yield per plant (kg)	Juiciness (%)	Fruit yield per 1000 m2	Total soluble solids (0Brix)	Vitamin C (mg/100g of fruit pulp)
V3F1	3.67	9.43	1.78	24.64	59.31	8.49	8.51
V3F2	3.89	9.93	2.08	25.22	61.03	9.48	9.53
V3F3	3.51	10.23	2.15	26.42	63.9	9.9	10.78
F-test	**S**	**S**	**S**	**1.53**	**S**	**S**	**S**
S.Em. (+)	**0.13**	**0,28**	**0.2**	**3.05**	**0.56**	**0.23**	**0.24**
C.D. at 0.5%	**0.38**	**0.84**	**0.6**	**7.34**	**1.69**	**0.68**	**0.73**
C.V	**0.04**	**1.02**	**0.021**	**7.34**	**4.29**	**1.01**	**1.03**

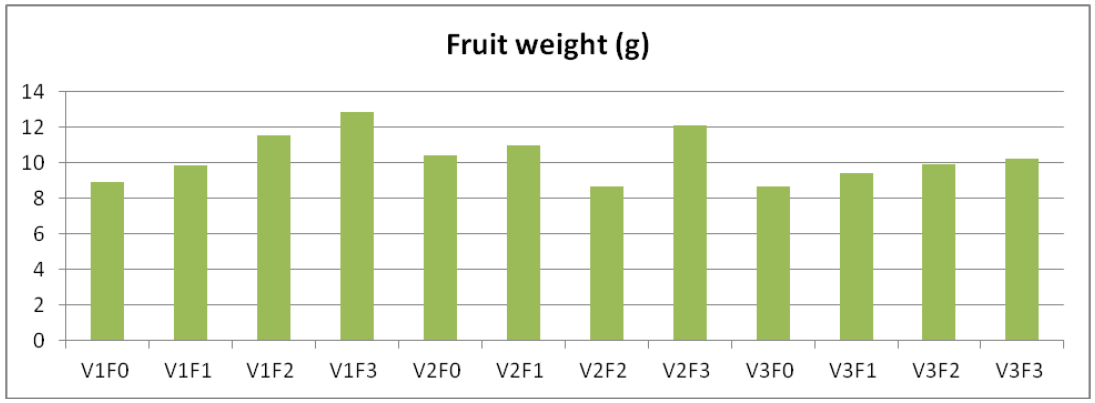

Fig. 11. Effect of different levels of fertilizer on fruit weight of different variety of cherry tomato

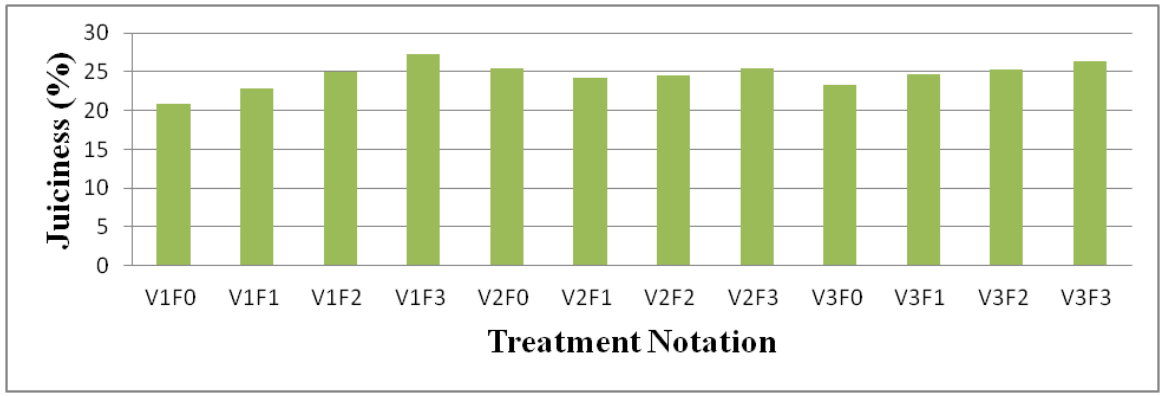

Fig. 12. Effect of different levels of fertilizer on of no fruits per plant of different variety of cherry tomato

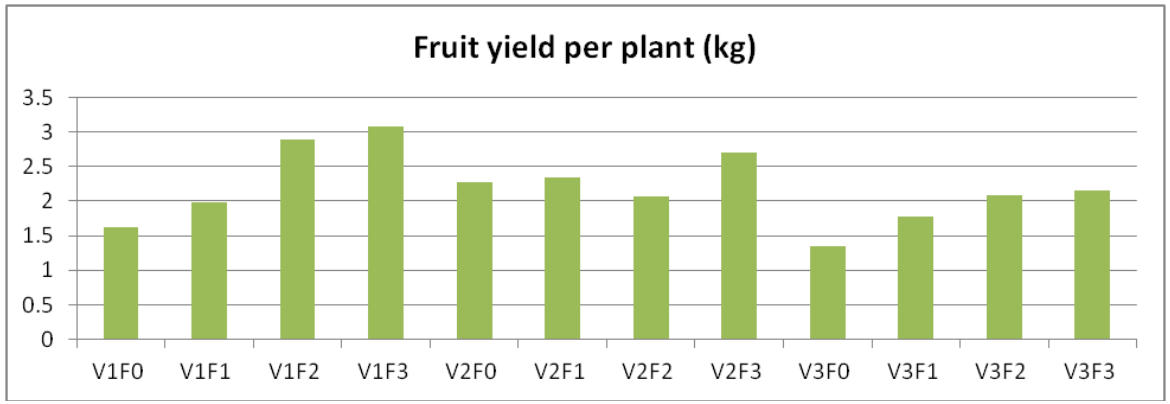

Fig. 13. Effect of different levels of fertilizer on fruit yield per plant of different variety of cherry tomato

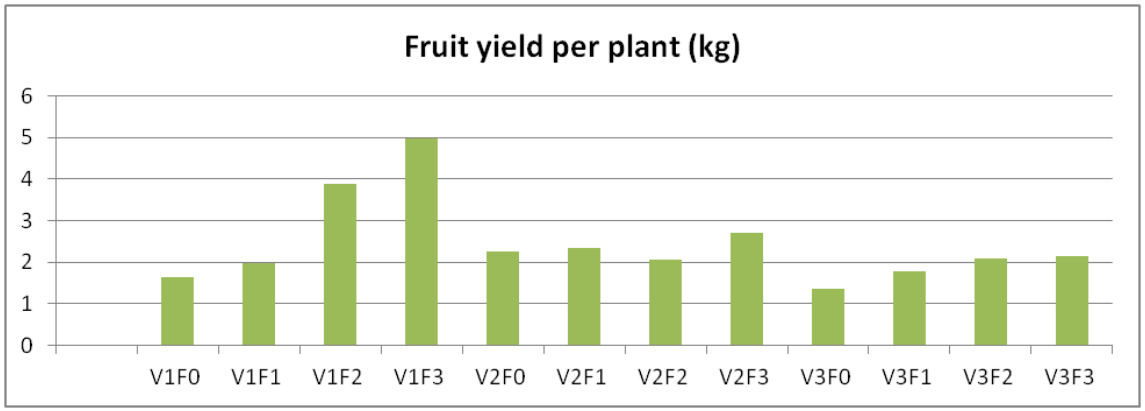

Fig. 14. Effect of different levels of fertilizer on fruit yield per plant of different variety of cherry tomato

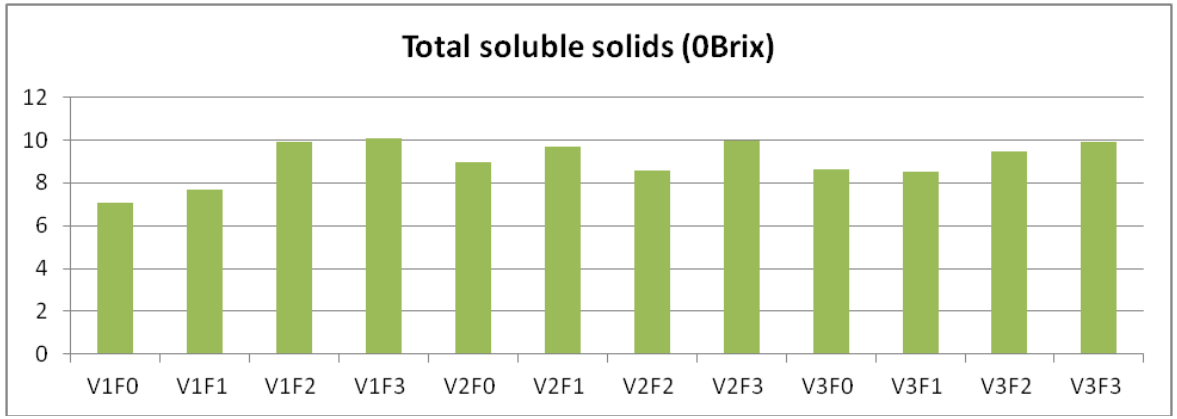

Fig. 15. Effect of different levels of fertilizer on total soluble solids of different variety of cherry tomato

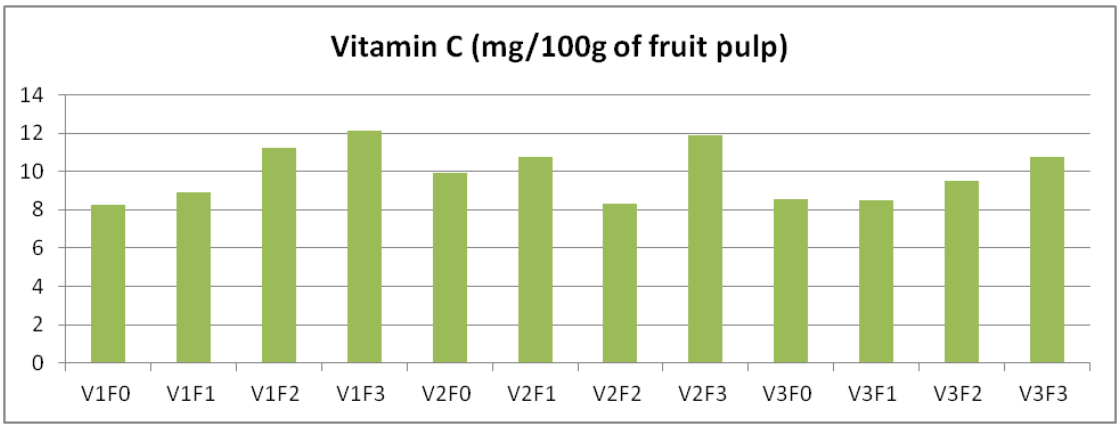

Fig. 16. Effect of different levels of fertilizer on vitamin C of different variety of cherry tomato

Ascorbic acid (%) was significantly varied with all the treatment concerned. It is evident that the ascorbic acid was affected by different treatments at all successive stage of storage. The percentage was found to increased with increase in storage time period.. Among the treatment used V1F3 (12.1) with Pusa cherry variety have highest ascorbic acid mean value followed by V2F3 with nagmoti variety which were significantly superior than Control and all treatment. The maximum ascorbic acid value in cherry tomato was recorded in V1F3 with 12.1 and the minimum was recorded in V1F0 (Control) with 8.25. Whereas Shakoor et al. (2015) observed ascorbic acid (from 3.87 to 3.69) was increased.

3.9.7 TSS

TSS (^{0}Brix) was significantly varied with all the treatment concerned. It is evident that the TSS was affected by different treatments at all successive stage of storage. There was significant differences between the treatments at Initial and other replication. Among the treatment used V1F3 treatment with (10.1) and have highest TSS ^{0}B which were significantly superior than T0 (Control) and other treatment. The maximum TSS value in cherry tomato was recorded in V1F3 with 10.1 ^{0}B and the minimum was recorded in T0 (Control) with 7.02 ^{0}B. A slight increase in total soluble solids during storage might be due to conversion of polysaccharides into sugars during hydrolysis process. Similarly Shakoor et al. (202) observed that total soluble solids (from 61.85 to 63.70) was increased.

3.10 Economics of Treatments

Observations on economics of treatments viz., total cost of cultivation, gross return, net return, and benefit cost ratio were calculated and has been presented in Table 9.

3.10.1 Cost of production

The maximum cost of production was recorded under all treatment taken approx same for all same price Rs 71000.

3.10.2 Gross return

The maximum gross return was found in (RS. 478800/ha) with treatment V1F3 and the variety was found highest gross return Pusa cherry. The lowest value of gross return found Rs. 372750. with the treatment V3F0 with control sample.

3.10.3 Net return

The net return was recorded under Pusa cherry V1F3 i.e. Rs. 407800/ha whereas minimum recorded in V3F0 with Rs. 35650/ha.

3.10.4 B:C Ratio

Higher B:C Ratio was recorded under V1F3 treatment i.e. 1:6.7 meanwhile minimum B:C Ratio recorded inV3F0 with 1:5.6.

Similarly, Kudi et al. (2016) found in their study that application of 36 kg N, 70 kg P2O5 and 30 kg S/ha gave the highest net return (Rs. 62369/ha) and benefit: cost ratio (3.39) were observed under dual seed inoculation with Rhizobium and PSB along with application of 24 kg N, 50 kg P2O5, 20 kg S/ha.

Table 8. Economics of treatment of cherry tomato (Fixed Cost) of var.

Sl. No.	Treatment name	Total COST of cultivation	Selling price (Rs.)	YPP (Kg/plot)	Gross return (Rs.)	Net return Rs./ha	Cost benefit ratio
T_1	V1F0	67100	105	37.7	395850	328750	5.9
T_2	V1F1	69100	105	39.1	410550	341450	5.9
T_3	V1F2	70500	105	43.2	453600	383100	6.4
T_4	**V1F3**	**71000**	**105**	**45.6**	**478800**	**407800**	**6.7**
T_5	V2F0	67100	105	36.5	382725	315625	5.7
T_6	V2F1	68200	105	38.8	406875	338675	6.0
T_7	V2F2	69100	105	39.2	411075	341975	5.9
T_8	V2F3	70105	105	40.5	425250	355145	6.1
T_9	**V2F0**	**67100**	**105**	**35.5**	**372750**	**305650**	**5.6**
T_{10}	V3F1	67800	105	38.9	408450	340650	6.0
T_{11}	V3F2	68400	105	39.9	418950	350550	6.1
T_{12}	V3F3	69130	105	42.2	442575	373445	6.4

Table 9. Cost of cultivation of cherry tomato (Fixed Cost) of var.

Sr.	Particulars	Quantity	Unit	Unit rate (INR)	Amount
A	**Land preparation**				
1	Ploughing with mould board	3	Hours	500	1500
2	Disc harrowing	3	Hours	500	1500
3	Planking and leveling	2	Manday's	350	700
4	Manday's for Layout	8	Manday's	350	2800
B	**Seed**	500	g	10	5000
1	**Fertilizer**				
a.	**N**	100	kg	7	700
b.	**P**	100	kg	27	2700
C	K	100	kg	30	3000
2	Manday's for Fertilizer Application	10	Manday's	350	3500
C	**Other material**				

Sr.	Particulars	Quantity	Unit	Unit rate (INR)	Amount
1	Jute Rope (Suth)	50	Kg	30	1500
2	Bamboo Sticks	1000	Nos.	1	1000
D	**Irrigation**				
1	Tube well charges (2hrs per irrigation)	8	Hours	300	2400
2	2 Manday's per irrigation	8	Manday's	350	2800
E	**Intercultural operations**				
1	Pruning of Branches	15	Manday's	350	5250
F	**Harvesting**				
1	6 Manday's per day for 8 days	35	Manday's	350	12250
2	Transportaion charges				500
G	**Overhead cost**				
1	Supervision charges	4	Months	3000	12000
2	Rental charges of land	4	Months	2000	8000
	Fixed cost of cultivation				**67100**

4. SUMMARY AND CONCLUSION

4.1 Summary

1. **Number of branches per plant:** Maximum number of branches per plant found in treatment V1F3 (15.11) and minimum in treatment V2F0 (9.61).
2. **Plant height (cm):** Highest plant height of the treatment (cm) was recorded in V1F3 treatment (143.40 cm) while the lowest was in treatment V2F0 (130.1 cm).
3. **Number of flowers per cluster per plant:** Number of flowers per cluster per plant was highest in treatment V1F3 (30.15 cm) with lowest recorded treatment V2F0 and V3F0 both with same value 23.23.
4. **Highest number of fruits per plant:** Highest number of fruits per plant was noted in treatment V1F3 (30.33) whereas the lowest was in treatment V2F0 (25.28).
5. **Fruit diameter (cm):** Fruit diameter (cm) was highest in treatment V1F3 registering 4.53 cm with the lowest in treatment V3F0 (2.36 cm).
6. **Individual fruit weight (g):** Individual fruit weight (g) was significant and recorded maximum fresh weight of 12.87 while the minimum was recorded in treatment V3F0 with 8.65 g.
7. **Number of fruits per plant:** It is showed that maximum fruits per plant was found in treatment V1F3 i.e. 244.15 and minimum in treatment V3 F1 i.e. 225.67.
8. **Fruit yield per plant:** Fruit yield per plant was significant with maximum yield recorded in treatment V1F3 (3.08 kg) and minimum in treatment V3F0 (1.55 kg). This was translated in tones per hectare.
9. **TSS percentage (^{0}B):** A significant difference found among all the treatments regarding Total Soluble Salts. It is showed that maximum Total Soluble Salts found in treatment V1F3 i.e. 10.1 ^{0}B whereas, minimum in treatment V3F0 i.e. 7.06 ^{0}B.
10. **Ascorbic acid percentage (mg/100 g):** Ascorbic acid percentage (mg/100 g) was registered as highest in treatment V1F3 (12.1mg/100 g) and lowest in treatment V3F0 with 8.25 mg/100 g.
11. **The maximum yield per plant, gross return, net return and cost benefit ratio:** The maximum yield per plant, gross return, net return and cost benefit ratio was recorded in the Treatment V1F3 Rs 48.600 gm, Gross return Rs 478800 and Net Return Rs 407800 and Cost Benefit ratio Rs 1:6.7.

4.2 Conclusion

Based on the above summarized findings it could be concluded that growth and yield parameters of cherry tomato were favorable in V1F3 (V1-Pusa Cherry -1@ 40+17+45 kg/1000m^2) treatment, quality parameters viz. TSS were found to be maximum value of the treatment . In this regard it could be concluded that treatment V1F3 was the best regarding growth, yield and quality parameters. Hence, this could be recommended to achieve the satisfactory yield and quality of cherry tomato with and benefit cost ratio of (1:6.7) as well as total production of the Cherry tomato cultivar “Pusa Cherry-1”.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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