

SYNOPSIS

Comparative analysis of Cherry Tomato cultivars under different crop management and growth conditions”

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CERTIFICATE

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INTRODUCTION

Cherry tomato (*Solanum lycopersicum* var. *cerasiforme*) is a botanical variety of the cultivated tomato. It is thought to be the ancestor of all cultivated tomatoes. It has become more popular all over the world because of a good source of vitamins A and C, solids content, good taste and fruit set even at high temperature (Prema et al., 2011). It is marketed at a premium to ordinary tomatoes. Cherry tomatoes are widely cultivated in Central America and are distributed in California, Korea, Germany, Mexico and Florida. Its fruits are consumed more as a fruit rather than as a vegetable. Cherry tomato often called salad tomato, though cherry tomato became popular as a cash crop in some Asian countries is still new in India. It is a warm season crop, sensibly tolerant to heat and drought and grows under wide range of soil and climatic conditions (Anon, 2009). Cherry tomato are perfect for making processed products like sauce, soup, ketchup, puree, curries, paste and sandwich. The size of cherry tomatoes range from thumb tip to the size of a golf ball and can range from being spherical to slightly oblong in shape (Anon, 2009). The possible exploitation of hybrid vigour in cherry tomato has been taken up at few research centres however very little systematic attention has been paid by plant breeders to study performance for yield and its components in cherry tomato. Cherry tomatoes are determinate, semi-determinate, and indeterminate growth habit with long racemes and many fruits of intense color and flavor and weighing between 10 and 30 g. Cherry tomatoes are resistant to diseases and tolerant to high relative humidity (>80%), have high nutritional value because of high vitamin C content and present a highly variable number of fruits per cluster (15-50). Lycopene content of cherry tomato exceeds 10mg/100g fresh weight which is considered as high. Its fruits are consumed more as a fruit rather than as a vegetable (Islam *et al.* 2012). These have powerful anti-cancer properties, useful against mouth cancer. Acidosis is quite common in our society leading to many ailments such as headache, fatigue, sleeplessness, absorption problems, arteriosclerosis, muscular aches and loss of calcium from the bones. Thus these problems can be prevented by adding tomatoes to diet as they have an alkali power.

PROBLEM BACKGROUND

India is largest producer of tomatoes, so India has vast scope to increase the production in order to produce export besides meeting its domestic requirements continuous efforts are made at various levels to increase productivity of tomatoes but it does not gain momentum.

India is new in cherry tomato production and most of the cultivation of cherry tomatoes is done in controlled conditions like in polyhouses, greenhouses, net shade etc and these structure are very costly where large investment is required to manage or construct polyhouses, greenhouses which is not possible for every farmer.

Moreover well skilled labour is required for training pruning practices, technician person for maintaining and handling controlled conditions. In open field environment factors effect growth and yield of crops diseases and pests problems. Fruit of cherry tomato is perishable so there is no proper storage facilities, no proper marketing such problems are been faced by farmers.

Review of Literature

Dudi and Sanwal (2004) evaluated the performance of 150 F1 hybrids of tomato under Haryana conditions and observed maximum and minimum plant height in HTH-18 (156.8 cm) and Rupali (53.8cm) respectively.

Singh *et al.* (2005) while studying the effect of NPK levels on growth and yield of tomato hybrids under poly house during early-winter seasons of 2000-02 recorded maximum plant height in the hybrid, Sun 7611 (3.13 m) followed by Naveen (3.06 m).

Thangam and Thamburaj (2008) studied the comparative performance of six varieties and fourteen hybrids of tomato under agro shade net (50%) and in open field during consecutive summer seasons at Coimbatore condition and reported highest plant height under shade over the open field conditions in all the cultivars and hybrids. Among the cultivars, Naveen was the tallest (307.58 cm) both under shade and open field condition (88.45 cm).

Kumar and Arumugam (2010) while testing the suitability of poly house grown tomato for growth and yield at Madurai conditions reported significantly maximum plant height (245.68 cm) under poly house conditions compared to open field conditions (115.76 cm).

Prema *et al.* (2011) evaluated six genotypes (Tomy Toe, Stupice Harry, Red Pear, Podland Pink, Broad Ripper and EC-1) of cherry tomato for growth, yield and quality attributes under polyhouse revealed extremely semi-determinate to indeterminate growth habit in all the cultivars. The highest plant height recorded in Red Pear at both 60 and 90 DAP (126.66 cm, 146.80 cm).

Chapagain *et al.* (2011) had the opinion that plant height is an important trait in tomato cultivation under plastic house conditions. Among the tomato varieties evaluated under plastic house conditions of Nepal for two consecutive years from 2009 to 2010, Srijana was the tallest variety (268.70 cm) followed by Manisha (232.3 cm)

El-Amin and Randa (2012) investigated the adaptability and productivity of four standard tomato varieties viz., Chanoa, Merel, Sensie and Yursa and two cherry varieties viz., Tomi and Elitro under plastic house conditions of Sudan observed highest plant height for cherry tomato variety Elitro (265.5 cm) followed by the normal tomato variety Merel (255.1 cm).

Razzak *et al.* (2013) conducted a greenhouse experiment on response of cherry tomato to pruning systems and irrigation rates and reported that one branch pruning produced the tallest Plants (195.3 and 190.1 cm) in the first and second seasons respectively. Fifteen tomato varieties were evaluated for growth and yield performance under controlled environment conditions by Wahundeniya *et al.* (2013). Among the fifteen varieties the maximum plant height was observed with variety Alambra F1 (185 cm) while the lowest plant height was recorded in the variety Red Boy (93 cm).

Nagalaxmi *et al.* (2001) reported higher number of primary branches in the tomato variety S-41 grown under poly house when compared to the crop raised under open field condition. Similarly in an another experiment the genotype VTG-5 (3.5) recorded maximum number of primary branches while, the genotypes VTG-27 and VTG-28 recorded minimum (2.0) number of primary branches (Lakshmi and Mani 2004).

Hazarika and Phookan (2005) conducted an experiment to evaluate 27 tomato cultivars for polyhouse cultivation in relation to growth, yield and quality, recorded highest number of branches plant-1 in the cultivar Yash (14.07).

Thangam and Thamburaj (2008) while evaluating the performance of six varieties and fourteen hybrids of tomato under agro shade net (50%) and in open field condition simultaneously during consecutive summer seasons recorded higher number of primary branches (4.52) in Ishwarya Lakshmi under shade net compared to open field (3.15).

Parvej *et al.* (2010) record similar results of increased number of branches plant-1 under polyhouse conditions as against the open field conditions in tomato.

Nagalaxmi *et al.* (2001) reported that tomato variety S-41 grown under poly house was earlier in flowering (29.6 days) over open field condition (32.4 days).

Pandey *et al.* (2006) evaluated four tomato varieties under polyhouse condition of Nepal and found significantly shortest period of days to flowering in both the years of study with the cultivar, NSITH-162 (35 and 36 respectively).

Prema *et al.* (2011) evaluated six genotypes (Tomy Toe, Stupice Harry, Red Pear, Podland Pink, Broad Ripper and EC-1) of cherry tomato for growth, yield and quality attributes. Early flower initiation was recorded in Broad Ripper (29.5days) followed by Stupice Harry (30.5 days).

Sumathi *et al.* (2013a) evaluated the performance of 24 tomato genotypes under polyhouse and open condition for yield characters observed the earlier flowering in genotypes raised under open condition than in polyhouse condition. During the first season earliest flowering (28.35 days) was observed in the genotype NS6666 and in second season, Meenakshi (23.80 days) was observed to be earlier under open condition.

In a study conducted to evaluate the performance of the tomato varieties under controlled environment conditions by Wahundeniya *et al.* (2013), the check variety Thilina took the longest period to flower (35 days after transplanting) and varieties N-83, N-17, N-139 and Red Boy took the shortest period of 30 days after transplanting.

Singh *et al.* (2013) evaluated the performance of nineteen tomato hybrids during the *rabi* 2008-09 and 2009-10 at Hissar under greenhouse conditions reported minimum number days to flowering in 50 per cent plants (79) with the hybrid Centurian.

Jana and Bhattacharya (2001) reported maximum number of flower clusters plant-1 and the longest flowering period in Naveen when grown under polythene shade.

Parvej *et al.* (2010) reported that polyhouse plants had significantly higher number of flowers cluster-1 than plants grown in open field. The tomato variety Tomato-3 showed significantly higher number of flowers cluster-1 as compared to Ratan. An experiment was conducted to evaluate and identify the superior and most promising F1 hybrids in respect of productivity and quality in a low cost plastic greenhouse by Sharma *et al.* (2011). Out of 16 hybrids, cherry tomato hybrid BSS-366 recorded the maximum number of cluster-1 (8.33) in EC-1 followed by Stupice Harry (8.20).

Aguirre and Cabrera (2012) conducted an experiment on 31 most promising varieties of cherry tomato for fruit production and quality. Among the varieties maximum number of flowers raceme-1 recorded in IAC421 (35.40) followed by IAC424 (35.00).

Similarly in another experiment by Arora *et al.* (2007) maximum number of fruits truss-1 was recorded in TH-806 (11.9), while least number was recorded in NP-5 (3.5).

Parvej *et al.* (2010) reported that polyhouse plants had significantly higher number of fruits cluster-1 than plants grown in open field.

Prema *et al.* (2011) number of fruits cluster-1 was maximum in Stupice Harry and EC-1 (7.13) followed by Broad Riper (6.46) among the six cherry tomato genotypes tested. Out of 16 tomato hybrids, cherry tomato hybrid BSS-366 (9.53) recorded the maximum number of fruits cluster-1 (Sharma *et al.* 2011).

Singh *et al.* (2013) conducted a study during the *rabi* season for two consecutive years at Hissar to evaluate the performance of nineteen tomato hybrids under greenhouse conditions, recorded maximum number of fruits cluster-1 in hybrid Centurian (5.8).

Papadopoulos and Ormrod (1991) evaluated two tomato cultivars Jumbo and Ohio CR-6 under greenhouse conditions reported significantly higher number of clusters in Jumbo (5.04) over Ohio CR-6.

Parvej *et al.* (2010) reported that polyhouse plants had significantly higher number of fruiting clusters plant-1 than plants grown in open field.

Ishwarappa (2011) studied the performance of tomato hybrids under shade house condition. Among the hybrids he has studied STH-801 recorded highest number of clusters plant1 (12.15).

Chapagain *et al.* (2011) assessed the performance of tomato varieties under plastic house. The varieties differed significantly for all the observed traits. Among the varieties, Srijana recorded maximum fruit clusters plant-1 (36.23).

Islam *et al.* (2012) found CH155 had the highest number of fruiting clusters plant-1 (39.8), while CLN1555A had the lowest number (12.25) among the 11 inbred lines of cherry tomatoes tested.

Razzak *et al.* (2013) studied the response of cherry tomato to pruning systems under green house conditions in Saudi Arabia during the 2010-11 and 2011-12 growing seasons. Results reveal that the plants pruned to two branches exhibited 35.6 per cent increase in total fruit yield compared to the plants pruned to a single branch in the first season and 40.3 per cent increase for the second season due to the maximum number of clusters (17 fruit clusters plant⁻¹) in two branch pruning as against 12 fruit clusters plant⁻¹ in one branch pruning.

Sumathi *et al.* (2013) reported the maximum number of fruiting clusters plant⁻¹ in the hybrid Realeza (19.85 and 13.47) both in first and second seasons respectively.

Cheema *et al.* (2002) reported maximum fruit set in IAHS-9502 under net house conditions when grown from December to March.

Hazarika and Phookan (2005) evaluated the performance of twenty seven tomato cultivars under poly house conditions recorded significantly maximum fruit set percentage with the cultivar Yash (83.96) while, fruit setting was least in Karna (64.09). Pandey *et al.* (2006) compared four tomato varieties under polyhouse condition and found that fruit set was highest in NSITH-162 (93.90%) and the lowest in Avinash-2 (83.10%) Similarly Arora *et al.* (2006) recorded significant difference in fruit set percentage in indeterminate tomato hybrids in green house. Maximum fruit set percentage was recorded in Avatar (88.0), while minimum was recorded in TH-612 (62.0). Among the different semi-indeterminate tomato hybrids studied maximum percentage of fruit set (84.0) was recorded in NP-5003 and TH-977, while minimum (50.0) was recorded in ARTH-210 (Arora *et al.* 2007).

Prema *et al.* (2011) evaluated six genotypes (Tomy Toe, Stupice Harry, Red Pear, Podland Pink, Broad Ripper and EC-1) of cherry tomato for growth, yield and quality attributes. The per cent fruit set was maximum (88.54) in EC-1 followed by Stupice Harry (88.10). Whereas, Ishwarappa (2011) observed maximum per cent fruit set in STH-801 (93.17).

Hussain *et al.* (1990) in a trial on performance of eleven tomato hybrids grown under unheated plastic tunnel reported that fruit maturity period ranged from 108 to 111.3 days in different tomatoes. Among the six indeterminate tomato hybrids tested by Singh *et al.* (2001), Hybrid-10 (141) is reported to be earlier for fruit maturity followed by Naveen (143) days.

Pandey *et al.* (2006) compared four tomato varieties grown under polyhouse and found that NSTIH-162 took the shortest period of days to fruit maturity (66 days).

Parvej *et al.* (2010) reveals that polyhouse grown tomato plants prolonged the duration of fruit harvest by about 9 days as against open field condition.

Dudi and Sanwal (2004) observed maximum average fruit weight in Rupali (60.69 g) and minimum in HTH-88 (38.2 g). Among the eighteen indeterminate tomato hybrids, NTH-2008 recorded the maximum individual fruit weight (102 g) while Compary and Vishwas (25 g) recorded the minimum fruit weight (Arora *et al.* 2006).

Thangam and Thamburaj (2008), while investigating the performance of tomato varieties and hybrids under shade and open field conditions reported highest mean fruit weight of 59.50 g in hybrid Rashmi under shade as against 44.75 g under open conditions.

Sharma and Thakur (2008) recorded the highest average fruit weight in FT-5 (76.12 g) and lowest in UHF-659 (52.29 g) indicating that the poly house grown tomato performed with regard to all the yield and yield attributing characters compared to open field condition. Similar results of poly house grown tomatoes significantly exhibiting maximum average fruit weight (99.43g) was also reported by Ramesh and Arumugam (2010).

Ishwarappa (2011) assessed the performance of tomato hybrids under shade house condition recorded the highest average fruit weight (115.50g) with the hybrids, STH-39.

Prema *et al.* (2011) reported maximum fruit weight in Podland Pink (20.26 g) followed by Tomy Toe (14.41 g) cherry tomato genotype.

Islam *et al.* (2012) conducted genetic variability studies 11 inbred lines of cherry tomato under field conditions reported individual fruit weight ranging from 5.60 to 36.50 g.

Donald and Gary (1979) evaluated four cherry tomato varieties in spring and fall season for fruit length and found largest fruit with Large Cherry variety (1.4 inches). While, smallest fruit (0.8 inches) was produced by the variety Small Cherry. Thangam and Thamburaj (2008) observed higher fruit length (7.86 cm) in Rashmi under shade compared to open field conditions (7.23 cm).

Prema *et al.* (2011) reported maximum fruit length (3.56 cm) in cherry tomato cultivar, Podland Pink followed by Red Pear (3.13cm). Chapagain *et al.*(2011) reported largest fruit size in US-04 with a diameter of 5.78 cm.

Similarly Islam *et al.* (2012) found maximum fruit length (5.33 cm) in 88CLN1555A while, the line CH155 had the minimum fruit length (3.00 cm).

Sima *et al.* (2011) evaluated six tomato hybrids in greenhouse for yield potential and quality reported significantly highest fruit length for Monroe F1 (53.50 mm) followed by Menhir F1 (52.64 mm).

Oum (1995) reported widest cherry tomato with CH 156 (31.22 mm) and narrowest fruit with CH 267 (19.07 mm).

Ishwarappa (2011) conducted a field experiment to study the performance of tomato hybrids under shade house condition recorded the highest average fruit diameter with STH-39 (6.30cm). Similarly maximum fruit width was recorded in Podland Pink (2.83 cm) followed by Tomy Toe (2.45 cm) cherry tomatoes (Prema *et al.* 2011).

Sima *et al.* (2011) evaluated six tomato hybrids under greenhouse conditions for yield potential and quality of fruits observed maximum fruit width for Monroe F1 (66.21mm) followed by Menhir F1 (62.54 mm). Among the eleven inbred lines of cherry tomatoes evaluated by Islam *et al.* (2012) maximum fruit width was noticed in CLN1555A (4.5 cm) while, the line CH155 had the minimum fruit width (2.05 cm).

Jawaharlal and Veeraragavathatham (2003) while evaluating six tomato parents and hybrids under open field condition, obtained highest fruit shape index (1.07 and 1.67) in Processor 40 and KS.7 respectively.

Singh *et al.* (2001) reported maximum fruit shape index in Naveen (1.05) followed by ARTH-4 (1.02) indeterminate tomato hybrid.

Singh *et al.* (2005) reported maximum fruit yield plant-1 from Karnataka hybrid (2.85 kg) followed by Naveen (2.61 kg) under multi span polyhouse covered with UV stabilized polyethylene film conditions. In another study with eighteen tomato hybrids maximum yield plant-1 recorded in HYB- 99K-78 (4.45 kg) followed by NTH-2008 (4.39 kg) (Arora *et al.* 2006).

Islam *et al.* (2012) found maximum fruit yield plant-1 (1.89 kg) in CLN1555A followed by CLN1555C (1.82 kg) among the 11 inbred lines of cherry tomatoes studied. Similarly Singh

et al. (2013) studied the performance of different tomato hybrids under greenhouse conditions during the *rabi*

John *et al.* (2005) recorded the maximum (7.7 0B) TSS in cherry tomato genotype 02LI1058 and minimum in Castlette (5.7 0B). Hazarika and Phookan (2005) while, evaluating the performance of tomato cultivars under polyhouse conditions of Assam reported maximum TSS (6.54 0Brix) in tomato cultivars, Pusa Ruby and Arka Shreshta.

Shivanand (2008) reported significantly varied TSS among the different tomato hybrids. The highest TSS was recorded in T 1224 (5.21 0B) followed by TH 1389 (5.19 0B), US 2175 (5.170B) TSI-48 (5.13 0B) US 1196 (5.03 0B) and Anup (4.98 0B). While the hybrid Surya (2.980B) recorded the lowest TSS.

Islam *et al.* (2012) conducted the genetic variability studies in 11 inbred lines of cherry tomato and found highest total soluble solids from the line CH155 (5.7 %) followed by CLN1555A (4.9 %).

Razzak *et al.* (2013) studied the response of cherry tomato to pruning systems under green house conditions reported maximum TSS with one branch pruning system (10.47 0B) as against two branch pruning system (9.40 0B).

Toor *et al.* (2006) found that the level of titrable acidity for flavouriono cherry tomato fruit was 0.45-0.55%. Jayaprakashnarayan (2007) recorded maximum acidity in TP 35 (0.52%) and minimum in TP 26 (0.13%).

Razzak *et al.* (2013) studied the performance of cherry tomato to pruning systems reported maximum titrable acidity (0.60%) in one branch pruning system over two branch pruning system (0.54%) in both the years of study.

Sumathi *et al.* (2013b) studied the comparative performance of 24 tomato genotypes reported lower acidity percentage in both hybrids and varieties under polyhouse conditions over open field conditions. The mean acidity percentage for hybrids and varieties (0.56 and 0.61 respectively) is lower under polyhouse conditions over open field conditions (0.59 and 0.63 respectively).

Singh *et al.* (2001) studied the performance of indeterminate tomato hybrids during the summer reported maximum ascorbic acid (37.4 mg 100ml⁻¹) in FM-1 followed by Pant Bahar (20.25 mg 100 ml⁻¹).

Hazarika and Phookan (2005) reported significant variation among different tomato cultivars for ascorbic acid content. Highest ascorbic acid content is reported in the cultivar DRD-8014 (16.56 mg 100g⁻¹).

Prema *et al.* (2011) reported that the ascorbic acid content of six cherry tomato fruit varied between 21.22 mg 100 g⁻¹ (EC-1) to 27.48 mg 100 g⁻¹ (Podland Pink). Out of 16 tomato hybrids cherry tomato hybrid BSS-366 (28.39 mg100g⁻¹) recorded the maximum ascorbic acid (Sharma *et al.* 2011).

Razzak *et al.* (2013) in a study on response of cherry tomato to pruning systems under green house conditions reported maximum ascorbic acid in one branch pruning system (23.75 mg 100g⁻¹) over two branch pruning system (20.69 mg 100g⁻¹).

Stomova *et al.* (1998) reported lycopene concentration range of 2.10vto 6.95 mg 100g⁻¹ fresh weight in 35 cherry tomato lines.

John *et al.* (2005) evaluated two cherry tomato breeding lines with high β -carotene content and reported maximum lycopene content (54.20 $\mu\text{g gfw}^{-1}$) with the cherry tomato line Castlette and minimum (2.3 $\mu\text{g gfw}^{-1}$) with 02L1059.

Kuti and Konuru (2005) evaluated forty tomato varieties under green house and field conditions for their lycopene content reported that cherry tomato types with higher lycopene content in field grown tomatoes (91.90 mg kg^{-1}) than in green house grown (56.10 mg kg^{-1}) tomatoes. However the results were *vice versa* for cluster and round tomatoes.

Parvej *et al.* (2010) investigated the production potential of two tomato varieties under covered polyhouse along with an open field conditions and reported that tomato plants grown inside the polyhouse hastened first flowering by about 3 days as compared to the plants grown in the outside natural condition.

RESEARCH OBJECTIVES

To get finest cultivation practice of cherry tomatoes

Best method of crop management.

PGR role when temperature is high.

Estimating different characters on fruit yield under different growth conditions.

MATERIALS AND METHODOLOGY

Topic of Research:- Comparative analysis of Cherry Tomato cultivars under different crop management and growth conditions.

Location:- Agriculture Research Farm, Lovely Professional University, Phagwara.

Year of Experiment:- 2018-2019

Crop- Cherry tomatoes

Number of varieties- 3

Design- Randomized block design (RBD).

Replications:- 3 replications.

Treatments:- 3 treatments

Time of Sowing: 1-march-2018

Method of sowing- Bed sowing

Spacing – 60×45 cm^2

PARAMETERS TO BE OBSERVED:-

1. Plant height (cm)
2. Days to first flowering
3. Number of branches
4. Days to 50% flowering
5. Number of flower cluster
6. Number of fruit cluster
7. Percentage of fruit set
8. Days taken for fruit 1st harvesting
9. Average fruit weight
10. Fruit length (cm)
11. Fruit width (cm)
12. Fruit shape
13. Yield
14. Total soluble solids
15. Lycopene content

Layout Of RBD:-

POLYHOUSE AND OPEN FIELD

Replication 1	Replication 2	Replication 3
Variety 1	Variety 3	Variety 2
Variety 2	Variety 1	Variety 3
Variety 3	Variety 2	Variety 1

EXPECTED RESEARCH OUTCOME

The research outcome will be to know the association of yield of Cherry tomatoes both in polyhouse cultivation and open field cultivation, checking effect on growth of plants in open environment and under controlled conditions. Plant height, no. of branches, no. of fruits per plant, fruit length, fruit width, no. of fruit cluster etc. are to be noted. Each and every character have either positive or negative correlation on the yield.

Calculation to be done for finding benefit cost ratio and finding the best profitable cultivation practice. Impact of PGR to control effect of high temperature and considering fruit quality both in open and polyhouse sowing.

Moreover as cherry tomatoes are mostly grown in controlled environment and through this research in open field growing is also practiced and finding will be noted like problems, yield and other factors

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