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Original Research Article

Evaluation of Cherry Tomatoes under Shade Net For Growth and Yield Attributes

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A B S T R A C T

A field experiment was conducted during early kharif, 2013 at HC&RI, Anantharajupeta to study growth, yield parameters on eleven genotypes (IIHR-2871, IIHR-2872, IIHR-2873, IIHR-2751, IIHR-2753, IIHR-2876, Laila, Roja, Ruhi, Sheeja, and AFA 602) of cherry tomato. The plants were extremely indeterminate. Maximum plant height recorded by Roja followed by Laila. The highest number of primary branches per plant recorded in sheeja followed by IIHR-2876. The genotype AFA 602 took significantly minimum number of days for first flower initiation and minimum days to first fruit harvest. IIHR-2872 took least number of days for 50 per cent plants to flower and said to be an early genotype followed by Roja. Highest number of flowers per cluster, maximum number of fruits cluster, maximum number of fruiting clusters per plant and highest fruit set percentage was noticed in the genotype Sheeja. Fruit shape index was found maximum in Sheeja followed by Laila and Roja due to the oval shape of these fruits. Highest fruit volume was recorded in IIHR-2872 followed by IIHR-2751. The highest mean fruit yield per plant, highest fruit yield per plot and fruit yield per hectare was recorded in AFA-602 followed by Sheeja. The cherry tomato genotypes, AFA602 and Sheeja outperformed other genotypes in terms of yield when grown during early kharif under 50 per cent shade net. The genotypes, AFA 602, Sheeja and Roja were found to be early maturing.

Keywords

Cherry tomato, shade net, growth and yield parameters

Introduction

The tomato plant (*Lycopersicum esculentum* mill) presents a great variety of fruit characteristics, allowing its classification within different commercial groups. Among them, there is the cherry tomato, which has shown an increasing participation in the market. Cherry tomato (*Solanum esculentum* var. *Cerasiforme*) plants are one of the cultivars of tomato species. It has become, for many small farmers, a good alternative, for being rustic, productive, and marketable, besides tasting good. The fruits are used in many ornamental dishes, fresh market and are highly appreciated for the excellent sweet taste and attractive red colour, because of high lycopene content and also its various forms. The fruits of cherry tomato plants have pleasing appearances and a delicious taste, and are well accepted by consumers. 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

(Prema *et al.*, 2011). Cherry tomatoes are resistant to diseases and tolerant to high relative humidity, 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 fresh weight which is considered as high. Cherry tomato fruits are consumed more as a fruit rather than as a vegetable.

Materials and Methods

A field experiment was conducted to evaluate the performance of cherry tomatoes (*Solanum lycopersicum* L. var. *cerasiforme*) under 50 % shade net at Horticultural College and Research Institute, Anantharajupeta, Y.S.R District, Andhra Pradesh during the early *kharif*, 2013. The present experiment consists of eleven cherry tomato genotypes viz., IIHR-2871, IIHR-2872, IIHR-2873, IIHR-2751, IIHR-2753 and IIHR-2876 collected from IIHR, Bangalore.

Laila, Roja, Ruhi, Sheeja, from Known you seed company and AFA 602 from Ashoka seed company. Nursery was raised in plastic pro-trays filled with sterilized coco peat. Raised beds of 4.5 m × 1 m width and 15 cm height with 50 cm walk space were prepared to raise the crop. The seedlings were transplanted under shade net at a spacing 60 cm × 45 cm between rows and plants respectively. Drip system was provided at the centre of each raised bed having emitting points at every 30 cm interval with discharge rate of 4 litres per hour. Black polythene mulch film of 100 micron thickness and 1.2 micron width used to cover the planting bed. Twenty five days old seedlings were transplanted under shade net by adopting a spacing of 60 cm × 45 cm. The experimental design was randomized block design with three replications. The plants were trained along the plastic twine. Drip irrigation was given daily to replenish 50 percent of open pan evaporation. Water soluble fertilizers were given through fertigation during entire crop period starting three weeks after transplanting with 19:19:19:, 13:0:45.

The growth and yield characters data were recorded on plant height, number of primary branches, days to first flowering, days to 50 % flowering, days to first fruit harvest, number of flowers per cluster, Number of fruits per cluster, fruiting clusters per plant, percent fruit set, average fruit weight, fruit length, fruit width, fruit shape index, fruit volume, fruit yield per plant, fruit yield per plot, fruit yield per hectare.

Results and Discussion

Plant height

The mean plant height ranged from 203.73 cm to 313.26 cm. The maximum value for plant height at 90 days after transplanting was recorded in Roja (313.26 cm) followed by Laila (312.20 cm). But statistically these varieties are at par with each other. Highest plant height in Roja and Laila hybrids could be attributed to the favorable micro climate inside the shade net, enhancing the growth and development by increasing the rate of plant response to diffused sunlight inside the shade net by way of photosynthesis and respiration resulting in longer inter nodal length and increase in the growth variables in terms of plant height.

Number of primary branches per plant

The hybrid Sheeja produced significantly highest number of primary branches per plant (3.20) followed by IIHR-2876 (3.00) but these two are statistically on par with each other. The differences observed in

number of primary branches per plant in cherry tomato plants might be due to genetic variations existing in genotypes.

Days to first flowering

The mean number of days to first flower initiation ranged from 28.40 to 36.13. The genotype AFA 602 (28.40) took significantly minimum number of days for first flower initiation followed by Ruhi and Roja, which took 29.88 and 30.40 days respectively. The genotype IIHR-2751 took maximum number of days (36.13) for first flower initiation followed by IIHR-2873 (35.86). However these two genotypes are statistically at par with each other. Early flowering is an indication of early fruit formation and consequently helps in getting early and high yields. The early flower initiation in AFA 602, Ruhi and Roja might be due to higher capacity of these growing types to make available assimilates to the reproductive site during sensitive phase before flower initiation and congenial micro climate inside the shade net. Similar results reported by Thangam and Thamburaj (2008) in tomato and Prema *et al.,* (2011) in cherry tomato.

Days to 50 % flowering

The mean number of days taken for 50 per cent plants to flower ranged from 39.66 days to 51.00 days. The genotype, IIHR-2872 took least number of days (39.66) for 50 per cent plants to flower and is said to be an early genotype followed by Roja (41.33) for 50% flowering but statistically on par with each other. The data on days to 50 per cent flowering among the cherry tomato genotypes shows that the genotypes are statistically at par with each other because such characters are controlled by genetic make-up and least affected by the changes in micro-climate under shade house conditions and optimum light and temperature. These results are in accordance with the findings of Arora *et al.,* (2007), Thangam and Thamburaj (2008) in tomato, Prema *et al.,* (2011) in cherry tomato and Singh *et al.,* (2013) in greenhouse tomato.

Days taken for first fruit harvest

Highly significant differences were observed with respect to days to first fruit harvest among the cherry tomato. The mean number of days taken for first fruit harvest ranged from 70 to 98 days.

The genotype, AFA 602 (70 days) took shortest period from transplanting to first fruit harvest followed by Roja (71) days, but both are statistically on par with each other. Earliness plays important role on fetching higher price and more income. Therefore early varieties are generally preferred for cultivation on commercial scale. Early harvest in this experiment might be due to the varietal response to the congenial growing environment in shade net and early flowering. Whereas delayed fruit ripening was due to late flowering. Similar results obtained by Prema *et al.,* (2011) in cherry tomato.

Number of flowers per cluster

Highly significant differences were observed among cherry tomato genotypes for number of flowers per cluster under shade net. The mean of number of flowers per cluster ranged from 4.66 (IIHR- 2872) to 10.70 (Sheeja). Highest number of flowers per cluster (10.70) was noticed in the genotype Sheeja followed by Ruhi (9.80) and Laila (9.60). However Sheeja, Ruhi and Laila are statistically at par with each other. This variation in number of flowers per cluster production among cherry tomato genotypes might be attributed to the inherent genetic

potentiality of the genotypes to produce flowers at controlled environmental condition. Similar results were obtained by Parvej *et al.,* (2010) in poly house tomato and Prema *et al.,* (2011) in cherry tomato. Aquirre and Cabrera (2012) and Muthuvel *et al.,* (2000) reported that number of inflorescences and stigma exertion are inherent characters.

Number of fruits per cluster

The mean of number of fruits per cluster ranged from 9.46 (Sheeja) to 3.26 (IIHR-2873). Significantly highest number of fruits per cluster was recorded by the genotype Sheeja (9.46) which is superior to all other genotypes like Ruhi, AFA 602 and Laila with number of fruits per cluster of 7.80, 7.40 and 7.20 respectively. Least number of fruits per cluster was noticed in IIHR-2873 (3.26) followed by IIHR-2872 (3.33). The significant variation among genotypes pertaining to number of fruits per cluster in the present study might be due to the genetic potentiality of genotypes responding to the favorable micro climate under shade house and similar results were obtained by Prema *et al.,* (2011), Sharma *et al.,* (2011) and Aguirre and Cabrera (2012) in cherry tomato.

Per cent fruit set

Highly significant differences were observed among the genotypes with respect to fruit set percentage. The mean fruit set percentage varied between 69.40 and 88.80. The fruit set percentage was maximum in Sheeja (88.8) which is at par with Roja, Laila, AFA 602 and Ruhi with a fruit set values of 88.8, 86.53, 82.80, and 81.10 per cent respectively. The increased fruit set might be due to higher rate of anther dehiscence, higher pollen viability and better response to shade net conditions. This also could be due to optimum light and temperature. The results obtained in the present study are in line with the findings of Prema *et al.,* (2011) in cherry tomato.

Table.1 Plant height, number of primary branches per plant, days to first flowering, days to 50 percent flowering, days to first fruit harvest in cherry tomatoes grown under shade net

Sl. No.	Genotype	Plant height (cm)			Number of primary branches Plant^{-1}	Days to first flowering	Days to 50 per cent flowering	Days to first fruit harvest
		30 DAT	60 DAT	90DAT				
1	IIHR-2871	**99.20**	**181.60**	**245.00**	**2.26**	**33.06**	**45.00**	**82.00**
2	IIHR-2872	**84.26**	**179.33**	**244.73**	**2.20**	**31.06**	**39.66**	**80.00**
3	IIHR-2873	**89.60**	**147.06**	**203.73**	**2.20**	**35.86**	**46.00**	**83.00**
4	IIHR-2751	**70.73**	**126.33**	**213.26**	**2.46**	**36.13**	**47.66**	**85.00**
5	IIHR-2753	**64.53**	**178.66**	**259.60**	**2.33**	**35.80**	**51.00**	**98.00**
6	IIHR-2876	**88.60**	**176.66**	**303.46**	**3.00**	**31.93**	**49.00**	**90.00**
7	LAILA	**97.33**	**205.06**	**312.20**	**2.06**	**31.66**	**43.66**	**73.00**
8	ROJA	**103.26**	**204.66**	**313.26**	**2.26**	**30.40**	**41.33**	**71.00**
9	RUHI	**89.60**	**214.40**	**292.20**	**2.13**	**29.86**	**42.66**	**74.00**
10	SHEEJA	**94.80**	**179.06**	**303.06**	**3.20**	**30.80**	**43.66**	**73.00**
11	AFA-602	**88.66**	**182.86**	**294.20**	**2.20**	**28.40**	**44.66**	**70.00**
	F-test	**	**	**	**	**	**	**
	SE(m) ±	**2.72**	**5.54**	**4.99**	**0.10**	**0.70**	**1.18**	**0.95**
	C.D. at 0.05	**8.10**	**16.46**	**14.82**	**0.31**	**2.09**	**3.52**	**2.82**

** Significant at 1% level of significance

Table.2 Number of flowers per cluster, number of fruits per cluster, fruit set percent, number of fruiting clusters per plant in cherry tomatoes grown under shade net

Sl. No.	Genotype	Number of flowers cluster $^{-1}$	Number of fruits cluster $^{-1}$	Fruit set percentage	Number of fruiting clusters plant $^{-1}$
1	IIHR-2871	**6.86**	**5.06**	**77.76**	**20.46**
2	IIHR-2872	**4.66**	**3.33**	**73.07**	**29.80**
3	IIHR-2873	**4.73**	**3.26**	**69.40**	**14.60**
4	IIHR-2751	**5.93**	**4.66**	**78.84**	**26.53**
5	IIHR-2753	**6.80**	**4.80**	**70.70**	**18.46**
6	IIHR-2876	**6.40**	**4.66**	**73.33**	**29.46**
7	LAILA	**9.60**	**7.20**	**82.80**	**28.26**
8	ROJA	**7.06**	**6.06**	**86.53**	**29.66**
9	RUHI	**9.80**	**7.80**	**81.10**	**29.46**
10	SHEEJA	**10.73**	**9.46**	**88.80**	**31.46**
11	AFA-602	**8.40**	**7.40**	**82.28**	**26.93**
	F-test	**	**	**	**
	SE(m) ±	**0.45**	**0.25**	**3.07**	**0.85**
	C.D. at 0.05	**1.33**	**0.76**	**9.13**	**2.52**

** Significant at 1% level of significance

Table.3 Fruit length, fruit width, fruit shape index, fruit volume, average fruit weight, fruit yield per plant, fruit yield per plot, fruit yield per hectare in cherry tomatoes grown under shade net

Sl. No.	Genotype	Fruit length (cm)	Fruit width (cm)	Fruit shape index (L/B)	Fruit volume (cc)	Average fruit weight (g)	Fruit yield Per plant (kg)	Fruit yield Per plot (kg)	Fruit yield Per hectare (Tons)
1	IIHR-2871	**3.10**	**3.60**	**0.85**	**17.66**	**20.12**	**2.09**	**20.93**	**27.63**
2	IIHR-2872	**4.12**	**3.00**	**1.36**	**20.33**	**28.82**	**2.85**	**26.33**	**34.75**
3	IIHR-2873	**3.22**	**4.17**	**0.76**	**17.83**	**22.22**	**1.06**	**14.20**	**18.74**
4	IIHR-2751	**3.15**	**3.67**	**0.85**	**18.26**	**18.50**	**2.28**	**22.32**	**29.91**
5	IIHR-2753	**3.09**	**3.10**	**1.00**	**16.00**	**18.58**	**1.65**	**25.16**	**33.25**
6	IIHR-2876	**3.06**	**2.51**	**1.21**	**12.66**	**17.46**	**2.40**	**27.13**	**35.81**
7	LAILA	**4.05**	**2.11**	**1.91**	**9.00**	**16.38**	**3.32**	**36.91**	**47.94**
8	ROJA	**3.68**	**2.30**	**1.58**	**9.00**	**13.17**	**2.36**	**33.76**	**44.59**
9	RUHI	**2.59**	**2.63**	**1.00**	**10.66**	**10.50**	**2.42**	**32.10**	**42.39**
10	SHEEJA	**4.06**	**2.05**	**2.00**	**11.000**	**12.36**	**3.64**	**38.56**	**50.96**
11	AFA-602	**3.16**	**2.54**	**1.24**	**13.33**	**18.82**	**3.70**	**40.68**	**53.70**
	F-test	**	**	**	**	**	**	**	**
	SE(m) ±	**0.06**	**0.05**	**0.02**	**0.34**	**0.36**	**0.1**	**1.07**	**1.42**
	C.D at 0.05	**0.18**	**0.14**	**0.07**	**1.02**	**1.07**	**0.46**	**3.18**	**4.24**

** Significant at 1% level of significance

Number of fruiting clusters per plant

Genotypes differed significantly among themselves for number of fruit clusters per plant. The mean number of fruiting clusters per plant ranged from 14.60 to 31.46. Among the genotypes, Sheeja (31.46) followed by IIHR-2872 (29.80) had recorded the maximum number of fruiting clusters per plant at harvest whereas the genotype IIHR-2751 (14.60) recorded the minimum.

However Sheeja, IIHR-2872, Roja, IIHR-2876, and Ruhi were statistically on par with each other with mean number of fruiting clusters per plant of 31.46. 29.80, 29.66 and 29.46 respectively. These significant differences among the genotypes pertaining to mean number of fruiting clusters per plant might be due to the genetic potentiality of these genotypes responding to the favourable micro climate under shade house. These results are in accordance with the findings of Sumathi *et al.,* (2013a) in poly house tomato and Prema *et al.,* (2011) in cherry tomato.

Fruit Length (cm)

The longest fruit was recorded in genotype IIHR-2872 (4.12 cm) followed by Sheeja (4.06 cm) and Laila (4.05 cm). Highest fruit length of IIHR-2872, Sheeja and Laila genotypes is mainly due to their genetic character and the response of these genotypes to acclimatize to the shade net conditions.

Fruit width (cm)

The mean fruit width values ranged between 2.05 cm and 4.17 cm. The genotype IIHR-2873 (4.17 cm) followed by IIHR-2871 (3.67 cm) produced significantly highest fruit width, whereas lowest fruit width was recorded in Sheeja (2.05 cm) followed by Laila (2.11cm). These results are in line with the findings of Prema *et al.,* (2011) in cherry tomato.

Fruit shape index

Fruit shape index values ranging from 0.85 to 2.00. Fruit shape index was found maximum in Sheeja (2.00) followed by Laila (1.91) and Roja (1.58) which is mainly due to the oval shape of fruits in these grow types. Similar findings were reported by Singh *et al.,* (2001) in tomato.

Fruit volume (cc)

Significantly highest fruit volume was recorded in IIHR-2872 (20.33 cc) followed by IIHR-2751 (18.26 cc). Higher values of fruit length and width are the probable reason for higher fruit volume observed in the genotypes and genetic potential of these plants to produce larger fruits. Similar results were reported by Ishwarappa (2011) in green house tomato.

Average fruit weight (g)

Average fruit weight showed highly significant values among all the cherry tomato genotypes. The mean fruit weight ranged from 10.50 g (Ruhi) to 28.82 g (IIHR-2872).

Significantly superior fruit weight was recorded in IIHR-2872 (28.82 g) followed by IIHR-2873 (22.22 g). Ruhi (10.5g) followed by Sheeja (12.36 g) had recorded minimum individual fruit weight. This variation in average fruit weight might be due to inverse relationship existing between average fruit weight, and number of fruits per cluster. This was conformity with the findings of Prema *et al.,* (2011), Islam *et al.,* (2012).

Fruit yield per plant (kg)

Significant differences among cherry tomato genotypes were obtained with respect to fruit yield per plant. The mean fruit yield per plant ranged from 1.06 kg to 3.70 kg. The highest mean fruit yield per plant was recorded in AFA 602 (3.70 kg) followed by Sheeja (3.64 kg) and Laila (3.32 kg) but statistically at par with each other and the genotype IIHR-2751 (1.06 kg) produced lowest fruit yield plant. The highest fruit yield in AFA 602 is mainly due to maximum number of fruiting clusters per plant and higher fruit weight and vice versa with IIHR-2751. This increased yield per plant is due to earliness in flowering, increased number of flower clusters per plant, high fruit set percentage and large number of leaves, higher fruit weight and taller plants which intern increases the photosynthetic activity and ultimately leads to higher yield per plant. These results are in agreement with those obtained Prema *et al.,* (2011), Singh *et al.,* (2013).

Fruit yield per plot (kg /4.5 m^2)

The data on fruit yield per plot showed highly significant variation among cherry tomato genotypes. The mean fruit yield per plot ranged from 14.20 kg to 40.68 kg. The highest fruit yield per plot was registered in AFA 602 (40.68 kg) followed by Sheeja (38.68 kg) but AFA 602 and Sheeja are statistically at par with each other. Least fruit yield per plot was recorded by IIHR-2873(14.20 kg). This increase in yield per plot in AFA 602 and Sheeja may be due to significantly more number of fruit clusters per plant, number of fruits per cluster, higher fruit set percentage and individual fruit weight compared to other genotypes and also due to development of more efficient chloroplast in leaves triggered by the diffused sunlight condition under shade net. Similar results were reported by EI-Amin and Randa (2012) in tomato under poly house condition.

Fruit yield (t /ha)

The differences among the genotypes with respect to yield per hectare were highly significant and the mean values ranged from 18.74 t /ha to 53.7 t/ha. The highest fruit yield per hectare was recorded in the genotype AFA 602 (53.70 t/ha) followed by Sheeja (50.96 t/ ha) but statistically both are at par with each other. The genotype, IIHR-2873 (18.74 t/ha) followed by IIHR-2871(27.63 t/ ha) recorded significantly lowest fruit yield per hectare which is attributed mainly due to the less number of fruiting clusters per plant, poor fruit set and poor response of these genotypes to shade net conditions. The highest fruit yield per hectare in AFA 602 is attributed to better vegetative growth, early flowering, more number of fruits per cluster, highest average fruit weight, and higher fruit set percentage and taller plants over the other genotypes. This may be due to the inherent ability of the hybrids and their better response to controlled environmental conditions. Similar reports of better performance of hybrids due to genetic makeup have been reported by Singh *et al.,* (2013) in tomato under shade net conditions and Prema *et al.,* (2011), Aguirre and Cabrera (2012) and Razzak *et al.,* (2013) in cherry tomato.

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