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RESEARCH PAPER

Performance of twenty five recombinant tomato hybrids for their flowering parameters and physical fruit parameters

[1]B. C. UMESH, [2]R. V. PATIL, [1]D. JEEVITHA, [2]LAXMI PATIL AND [1]B. S. MANJULA

[1] Department of Agriculture, Karunya Institute of Technology and Science, Coimbatore - 641 114
[2] Department of Horticulture, University of Agricultural Sciences, Dharwad - 580 005, Karnataka, India
E-mail: hortiumeshbc850@gmail.com

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Abstract: The field experiment was conducted at new orchard of the Main Agricultural Research Station, Dharwad during the year *rabi* 2019-20 to study the performance of twenty five recombinant tomato double cross hybrids (*Solanum lycopersicum* L.) for their physical fruit parameters and flowering parameters. All these 25 genotypes showed significant variation with respect to physical fruit characters and flowering characters. Physical parameter *viz.*, fruit length (mm), fruit diameter (mm), fruit shape, fruit shape index (%), fruit color, and flowering parameters like days to 1st flowering and days to 50% flowering showed notable variation in all the tomato double cross hybrids. The hybrid line NS-526 x Shankara and Abhilash x S-85 recorded significantly higher fruit length (55.35 mm). However, the genotype MHAT-306 x Sindu showed the highest fruit girth (66.28 mm). The highest fruit shape index was reported in KTH-354 x Sagara (1.12%) line. Days to first flowering and minimum days to 50 percent flowering were observed in KSP-1326 x Shankara (14.50, 18.50 days, respectively) and MHAT-306 x NS-585 (14, 19.50 days, respectively).

Key words: Double cross, Flowering parameter, Fruit physical parameters, Recombinant

Introduction

Tomato (*Solanum lycopersicum* L.) with chromosome number 2n=2x=24, belongs to family solanaceae. It is one of most the popular and nutritious fruit vegetable, widely grown around the world and ranked second after potato. Globally, the area under tomato is 4.81 million hectares with production of 130 million tonnes (Anonymous, 2019). China, India and USA are the major tomato producing countries. In India, it is grown in an area of 0.77 million hectares with a production of 19.39 million tonnes and the average productivity is about 21.2 tonnes per hectare. The important tomato growing states are Andhra Pradesh, Karnataka and Madhya Pradesh. In Karnataka, tomato is grown on an area of 0.06 million hectare with a production of about 2.13 million MT with a productivity of about 33.55 tonnes per hectare (Anonymous, 2019).

The fruits are eaten raw or cooked. Large quantities of tomato are used to produce soup, juice, ketchup, puree, paste and powder. It is a rich source of vitamins, minerals, organic acids, sugars and lycopene. Nutritive value varies with cultivars depending upon the agro-climatic condition. It is also rich in nutrients and calories. It is a good source of Fe and vitamin A, B, and C. Edible portion of tomato contains energy 79 KJ, protein 0.76 g, fat 0.25 g, carbohydrate 3.20 g, total free sugars 1.82 g, glucose 0.18 g, Ca 8.90 mg, Fe 0.22 mg, Mg 11.86 mg, P 15.45 mg, K 167 mg, Na 11.86 mg, Zn 0.11 mg, vitamin C 22.8 mg, thiamin 0.04 mg, riboflavin 0.02 mg, vitamin B-6 0.08 mg, vitamin E 0.56 mg, lycopene 2481 ìg, citric acid 288 mg, total ascorbic acid 25.27 mg, total saturated fatty acids 47.65 mg, total polyunsaturated 119 mg per 100 g (Longvah *et al*., 2017). Consumption of tomato and its products can significantly reduce the risk of developing colon, rectal and stomach cancer. Studies suggest that tomatoes contain the antioxidant lycopene, which markedly reduces the risk of prostate cancer (Kucuk, 2001).

Global demand for tomato production is increasing tremendously due to its diverse utility in raw, cooked and processed form of food. This necessitates the continued supply of highly nutritious and better yielding improved cultivars to the producers, that to under the rapid changing agro-climatic conditions. Considering the importance of this crop, there is a need for improvement and to develop varieties suited to specific agro-ecological conditions and also for specific end use. A thorough knowledge regarding the amount of genetic variability existing for various characters is essential for initiating the crop improvement programme. With limited variability much cannot be achieved and the breeder will have to enrich the germplasm or he can resort to creating greater variability through recombination and mutation breeding.

In Karnataka, especially in Northern Karnataka region medium-fruited tomatoes with average fruit weight of 70 + 10 are preferred. Generally, the preference is for red coloured with green shoulders, glossy surface with round oblong and square round fruits. The food products prepared in this region are tomato curry, tomato rice, and it is main ingredient in all the curries. Various local cultivars are grown in this area which suffer from low productivity and susceptibility to insects-pest and diseases. Thus, under these circumstances, it is necessary to improve these genotypes or to develop superior hybrids to these genotypes in yield, maturity, better transportability, better fruit quality and other characters. Thus attempt was made for collection and evaluation of tomato genotypes for Karnataka region to study the growth and yield characters.

Material and methods

Plant materials

The present investigation was undertaken at the new orchard of Main Agriculture Research Station, UAS, Dharwad.

The research material was derived from 10 hybrids of tomato. The experimental material for present study comprised of 500 plants of 25 double cross F_1 genotypes of tomato. These 25 double cross F_1s were developed by crossing 5 SCF_1s × 5 SCF_1s in line × tester mating design for identifying heterotic with high sca effect performance resulting from crossing of genetically divergent genotypes (Kempthorne, 1957).

Evaluation

The material generated was evaluated in *rabi* 2019 by laying out in the Completely Randomized Block Design (RBD) with 25 lines were replicated twice. In each rows ten seedlings were transplanted for each entry in each replication. Totally 25 rows represented 25 entries. All the 500 plants along with one check planted with spacing 75 × 60 cm. Recommended practices were followed for successful cultivation as per UHS, Bagalkot package of practice.

The observations were recorded on five competitive plants taken at random in each entry over the replications on fruit length (mm), fruit diameter (mm), fruit shape index (%), fruit shape, fruit color, and flowering parameters like days to 1st flowering (days) and days to 50% flowering (days).

Analysis

Analysis of variance revealed that considerable variability among the genotypes for all the characters. The analysis of variance was done for all the parameters as per the method given by Kempthorne (1957) and emphasized by Arunachalam (1974). To record the biometric observations, sampling technique was used. Five plants from the net plot were selected randomly from each treatment per replication. The selected plants were marked by labeling. The flowering and fruit parameters were recorded at harvest of all the labeled plants and mean values for each observation were used for statistical analysis. Fruit shape index was worked out by dividing the length of the fruit by diameter of the fruit and fruit shape was examined based on the values of fruit shape index (Roy and Choudhury, 1972) and fruit colour was recorded by following the fruit color chart.

Results and discussion

All these twenty five tomato genotypes showed significant variation to physical characters of fruit and flower characters. Wide range of variation was observed in flowering and fruiting characters in tomato with respect to flower earliness, fruit shape, size and color.

1) Flowering Parameters

Significant variations were observed for days to first flowering in all the genotypes used for the study. Mean performance of genotypes for days to first flowering ranged from 14 days to 19.50 days with an overall mean of 17.10 days. The earliest flowering was recorded in MHAT-306 x NS-585

Table 1. Variation with respect to flowering and physical fruit parameters among the different recombinant genotypes of tomato

Crosses	Days to 1st flowering	Days to 50% flowering	Fruit length (mm)	Fruit diameter (mm)	Fruit shape	Fruit shape index (%)	Fruit color
NS-526 X Shankara	18.50	24.50	55.35	59.28	Flat Round	0.81	Red
NS-526 X Sindu	18.50	24.50	46.55	50.98	Flat Round	0.85	Red
NS-526 X S-85	16.50	21.50	53.65	52.68	Spherical	0.94	Red
NS-526 X Sagara	17.50	22.50	46.05	60.68	Flat Round	0.71	Red
NS-526 X NS-585	17.50	21.50	45.35	50.68	Flat Round	0.79	Red
KSP-1326 X Shankara	14.50	18.50	47.55	53.78	Spherical	0.93	Red
KSP-1326 X Sindu	18.50	23.50	44.35	60.38	Spherical	0.96	Red
KSP-1326 X S-85	18.50	23.50	46.05	58.98	Flat Round	0.83	Red
KSP-1326 X Sagara	17.50	22.50	53.85	61.38	Flat Round	0.82	Red
KSP-1326 X NS-585	18.50	23.50	50.15	41.88	Spherical	0.99	Red
MHAT-306 X Shankara	17.50	24.50	44.85	52.18	Oval	1.00	Greenshoulder
MHAT-306 X Sindu	19.50	24.50	40.15	62.28	Flat Round	0.76	Green shoulder
MHAT-306 X S-85	19.50	24.50	49.45	54.25	Spherical	0.86	Green shoulder
MHAT-306 X Sagara	15.50	21.50	40.75	45.08	Oval	1.09	Green shoulder
MHAT-306 X NS-585	14.00	19.50	48.05	56.48	Spherical	0.88	Green shoulder
KTH-354 X Shankara	16.50	25.50	52.15	57.38	Spherical	0.86	Red
KTH-354 X Sindu	16.50	23.50	47.05	49.98	Spherical	0.88	Red
KTH-354 X S-85	17.50	22.50	46.35	53.68	Flat Polar	0.69	Red
KTH-354 X Sagara	16.50	21.50	50.35	47.98	Oval	1.12	Red
KTH-354 X NS-585	16.50	21.50	36.35	45.78	Spherical	0.97	Red
Abhilash X Shankara	17.50	24.50	45.05	58.58	Spherical	0.92	Red
Abhilash X Sindu	17.50	23.50	36.35	52.58	Flat Round	0.84	Red
Abhilash X S-85	15.50	21.50	55.35	43.03	Oval	1.00	Red
Abhilash X Sagara	14.50	20.50	0.37	55.68	Spherical	0.90	Red
Abhilash X NS -585	18.50	23.50	0.77	59.38	Spherical	0.93	Red
Mean	17.10	22.70	47.11	53.80		0.89	
Check (AS-95)	24.50	32.50	57.75	57.75		0.86	
Range low	14	18.5	41.88	41.62		0.69	
Range high	19.5	25.5	62.28	74.92		1.12	
S.E.	0.37	-	0.113	-		0.003	

Fig. 1. Phenotypic variation observed for fruit shape and size in tomato

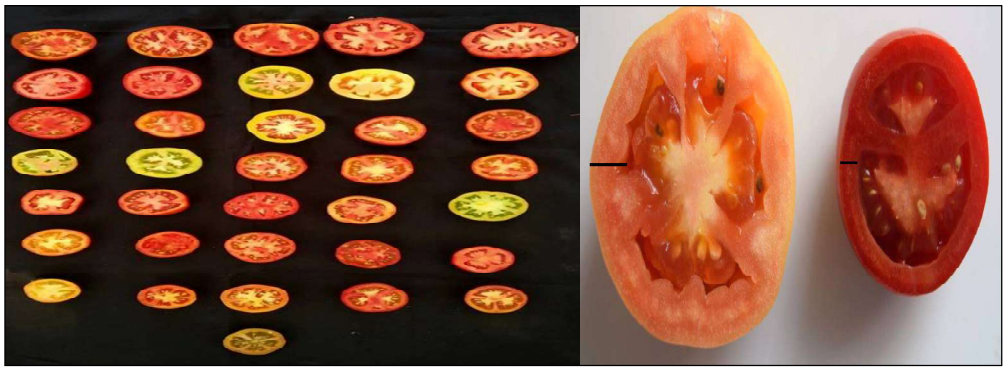

Fig. 2. Variation observed for fruit diameter, fruit shape and pericarp thickness in tomato lines

(14 days) followed by KSP-1326 x Shankara and Abhilash x Sagara (14.50 days). Above findings regarding to variation in first flowering in different tomato genotypes are in conformity with, Sureshkumara *et al*. (2017). Days to 50 per cent flowering showed significant differences among all the genotypes. Mean performance of genotypes for days to 50 per cent flowering ranged from 18.50 to 25.50 days. General mean for the character was 22.70 (days). Minimum days to 50 per cent flowering were recorded in the genotype KSP-1326 x Shankara (18.50 days) fallowed by MHAT-306 x NS-585 (19.50 days), whereas the genotype KTH-354 X Shankara had taken maximum days to 50 per cent flowering (25.50 days).

2) Physical parameters of fruit

Physical parameter *viz.,* fruit length (mm), fruit diameter (mm), fruit shape index (%), fruit shape, fruit color showed notable variation among all the genotypes of tomato (fig.1) (fig.2). Further, it was observed that all these fruit parameters significantly varied among all genotypes. Significant differences were observed among all the genotypes for fruit length. It ranged from 36.35 mm in Abhilash x Megha to 55.35 mm in NS-526 x GPBT-8. General mean for the character was 47.11 mm.

The genotype NS-526 x GPBT-8 recorded significantly the highest fruit length (55.35 mm), while the lowest in the genotype Abhilash x Megha (36.35 mm). The variation in above characters was also reported by Mishra *et al.* (2008) in brinjal genotypes.

Fruit diameter showed significant differences among all the genotypes. It ranged from 41.88 - 62.28 mm. General mean for the character was 53.80 mm. Maximum fruit diameter was observed in MHAT-306 x Sindu (62.28 mm). Minimum fruit diameter was recorded in KSP-1326 X NS-585 (41.88 mm). Whereas significant differences were observed among the genotypes for fruit shape index. It was observed more in KTH-354 X Sagara (1.12) and it was observed less in KTH-354 x S-85 (0.69). Genotypes which had more value they oval in shape and which have less value they flat polar in shape.

The data presented in Table1 revealed that tomato genotypes under study show the variation in fruit shape. The genotype MHAT-306 X Shankara, MHAT-306 X Sagara, KTH-354 x Sagara and Abhilash x S-85 produce the oval fruits, while the genotypes NS-526 x Shankara, NS-526 x Sindu, NS-526 x Sagara, NS-526 x NS-585, KSP-1326 x S-85, KSP-1326 x Sagara, MHAT-306 x Sindu and Abhilash x Sindu had the flat round fruits. With respect to fruit color there is wide variation observed among the different tomato genotypes under the study. The fruit colors *viz.,* Red and Green shoulder were the two colors observed most tomato genotypes.

Conclusion

Thus, from the results obtained and analyzed during the present investigation, it was concluded that all these twenty five genotypes of tomato differed significantly for most of the physical fruit characters under study. The fruit shape varied from oval to flat round to spherical in shape. The fruit colours *viz.,* green shoulder with orange at base and full reddish. All the flowering parameters varied significantly among all the tomato genotypes under study. The genotype MHAT-306 X NS-585 was found to be the earliest in initiation of days to first flowering and days to fifty percent flowering.

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