



E-ISSN: 2278-4136
 P-ISSN: 2349-8234
 JPP 2018; 7(1): 1605-1608
 Received: 14-11-2017
 Accepted: 15-12-2017

Manoj Kumar N
 Division of Vegetable Science,
 IARI, Pusa Campus, New Delhi,
 India

MK Rana
 Department of Vegetable
 Science, CCSHAU, Hisar,
 Haryana, India

Evaluation of tomato (*Solanum lycopersicum* L.) genotypes for yield and yield attributing characters in semi arid zone of Haryana (Hisar)

Manoj Kumar N and MK Rana

Abstract

The investigation was carried out at Research Farm of the Department of Vegetable Science, C.C.S. Haryana Agricultural University, Hisar during spring *Rabi* season of 2013-14. The data exhibited significant variation in 27 genotypes for different agronomical characters. The maximum plant height (130.33 cm) was recorded in genotype US 3140. The maximum number of branches per plant was observed in BBWR-10-3-18. Hisar arun was found early flowering variety which can be used in crop improvement programmes. Number of fruits per plant is highest in BBWR-11-1. The maximum polar diameter of the fruit was recorded by the genotype Hisar Lalit. The maximum equatorial diameter is shown by Arka Meghali. The fruit yield per plant of tomato evaluated varied significantly among the 27 genotypes, ranging from 495.73 to 1049.60 g. The general mean value of genotypes was 789.54 g. The minimum fruit yield per plant was recorded with genotype EC 620536, while maximum with genotype DVRT 2. The most promising genotypes having fruit yield greater than general mean were Palam Pride, Palam Pink, EC 620445, BBWR-11-1, EC 620380, Punjab Varkha Bahar-2, Hisar Arun, Arka Vikas, Saksham, Abhilash, Arka Meghali, US-3140 and Hisar Lalit. The highest TSS content of fruit was recorded with the genotype EC 620383. Acidity of the fruits at marketable stage was ranged from 0.56 to 0.80. The ascorbic acid content of fruit at marketable stage ranged from 15.05 to 31.37. The findings of this study may provide valuable information about phenotypic characteristics of studied cultivars for vegetable experts, researchers and growers under semiarid zone of Hisar.

Keywords: Genotype, tomato, Yield

Introduction

Tomato (*Solanum Lycopersicon* L.) is one of the most popular and widely grown vegetable in the world ranking second in importance only next to potato and ranked first in preserved and processed vegetables and in the international market there is great demand for tomato (Solieman *et al.*, 2013) [14]. Tomato crop has wider adaptability, high yielding potential and multipurpose uses in fresh as well as processed food industries. Tomatoes are an excellent source of minerals, vitamins (Akinfasoy *et al.*, 2011) [4], antioxidants viz., lycopene and beta-carotene which prevent cancer and other heart diseases (Kaur *et al.*, 2013) [9]. Development of tomato genotypes of a promising nature has been important to the vegetable industry throughout the world. New bred varieties have enriched and advanced the agriculture of many countries. Evaluation of germplasm is of immense important in genetic improvement of the crop. For the selection of parents in hybridization, diversity among parents for the character of interest (Harrington, 1940) [8]. The production and productivity not only depends on cultural practices and area of cultivation but on high yielding genotypes which have good adaptability to the growing area (Asiya *et al.*, 2017) [5]. Inclusion of genetically diverse parents in any breeding programme is essential to generate new variability and desirable recombinants. Hence, evaluation of tomato genotypes is very essential to see the performance of genotypes for their adaptability and agronomic performance like growth and yield traits to identify the potential genotype. Considering the above facts, the research has been planned with the following objectives to investigate the performance of different tomato genotypes in the semi arid tropics of Hisar, Haryana during spring summer in for its yield and related attributes.

Materials and Methods

The present investigation was carried out at Research Farm of the Department of Vegetable Science, CCS Haryana Agricultural University, Hisar during spring-summer 2013-2014. The experimental materials comprised of twenty-seven genotypes of tomato collected from different sources. The experiment was laid out in a randomized block design with three replications accommodating 14 plants in each genotype.

Correspondence
Manoj Kumar N
 Division of Vegetable Science,
 IARI, Pusa campus, New Delhi,
 India

Seeds were transplanted at a spacing of 75 × 45 cm. The genotypes evaluated and their source is given in Table 1. All the recommended cultural practices were adopted for raising the crop successfully. The observations were recorded on five randomly selected plants per replication for each genotype on fifteen characters: i) plant height (cm), ii) days to 50% flowering, iii) average fruit weight (g), iv) number of branches per plant, v) polar diameter (cm), vi) equatorial diameter (cm), vii) number of locules per fruit, viii) number

of flowers per cluster, ix) fruit yield per plant (g), x) number of clusters per plant, xi) number of fruits per plant, xii) number of fruit per truss, xiii) total soluble solids (%), xiv) acidity (%) and xv) ascorbic acid (mg/100 g). The quality parameters were analyzed as per the methods of A.O.A.C. (1984) [2]. Mean across three replications were calculated for each trait and the mean performance is assessed. The recorded data were statistically analyzed at 5% level of significance following the standard process as stated by Panse and Sukhatme (1967) [12].

Table 1: List of germplasm lines and standard released varieties included in the study

S. No.	Genotype/Origins	S. No.	Genotype/Origins
1	Palam Pride/Palampur	15.	Hisar Arun/Hisar
2	Palam Pink/Palampur	16.	Punjab Chhuhara/Hisar
3	EC 620445/NBPGR	17	EC 620516/ NBPGR
4	BBWR 11-1/Bangalore	18.	EC 620536/ NBPGR
5	BBWR 18-17/Bangalore	19.	Arka Vikas/IIHR
6	EC 620533/NBPGR	20.	Saksham/Monsanto
7	EC 620534/NBPGR	21	Abhilash/Monsanto
8	EC 620378/NBPGR	22	Arka Meghali/IIHR
9	EC 620383/NBPGR	23	US 1196/Dharwad
10	EC 620380/NBPGR	24	US 3140/Dharwad
11	EC 620391/NBPGR	25	DVRT 2/IVR
12	BBWR 10-3-17/Bangalore	26	S 12/Punjab
13	BBWR 10-3-18/Bangalore	27	Hisar Lalit/Hisar
14	Punjab Varsha Bahar 2/Punjab		

Note: -National Bureau of Plant Genetic Resources (NBPGR), Indian Institute of Vegetable Research (IIVR), Indian Institute of Horticultural Research (IIHR)

Results and Discussion

The results obtained from the present investigation on growth parameters exhibited significant difference by the genotypes (Table 2). The mean performance of different genotypes for different characters and grand mean for different characters are presented in Table 2. The maximum plant height (130.33 cm) was recorded in genotype US 3140 and the lowest plant height (59.66 cm) in EC 620536. Other varieties with plant height above one meter were EC 620533, EC 620380 and Saksham. Plant height of remaining genotypes was below one meter. The maximum number of branches per plant was observed in BBWR-10-3-18 and minimum in EC 620391. Significant differences were observed among the entries with respect to days to 50% flowering. The value ranged from 28.00 to 38.33 days. It is lowest in Hisar Arun and highest in EC 620383, respectively. Hisar arun as an early maturing variety in crop improvement programmes to dissect the gene responsible for early flowering and transfer to other genotypes in order to get superior varieties. The wide variation in growth parameters of all the genotype might be due to their genetic makeup, which indirectly governs the morphology of the plant that has a direct impact on the formation of floral buds since all the genotype were grown under the same climatic condition. These results are in conformity with the finding of Sankari, A., (2000) [17] and Ahmed *et al.*, (2007) [3].

A wide variation was found among the germplasm genotypes for the number of fruits per plant, which significantly varied from 19.53 to 40.53 among the genotypes. Eshateshabul *et al.* (2010) [7] reported the mean number of fruits per plant lay between 4.46 and 38.30 which is closely similar to findings in this study. The entry EC 620534 showed the lowest number of fruits per plant and BBWR-11-1 the highest number of fruits per plant. The other genotypes ranging above 30 were Punjab Varkha Bahar-2, Hisar Arun, EC 620516, DVRT 2 and S-12. The average fruit weight ranged from 21.51 to 46.27g. The minimum fruit weight was recorded by the genotype S-12 and maximum by US 3140. Similar findings

had been reported by several other authors including Turhan *et al.* (2011) [16]; Abrar *et al.* (2011) [1]. The minimum numbers of fruits per truss were recorded by the genotype Saksham and maximum by the genotype S-12. Besides S-12, the genotype EC 620516, EC 620391, DVRT 2 and Hisar Arun showed a good number of fruits per truss. The minimum polar diameter of the fruit was recorded by the genotype S-12 and maximum by Hisar Lalit. The maximum equatorial diameter is showed by Arka Meghali. The minimum number of locules was registered with genotype EC 620516, while maximum with genotype US 1196.

The fruit yield per plant of tomato evaluated varied significantly among the 27 genotypes, ranging from 495.73 to 1049.60 g. The general mean value of genotypes was 789.54 g. The minimum fruit yield per plant was recorded with genotype EC 620536, while maximum with genotype DVRT 2. The most promising genotypes having fruit yield greater than general mean were Palam Pride, Palam Pink, EC 620445, BBWR-11-1, EC 620380, Punjab Varkha Bahar-2, Hisar Arun, EC 620516, Arka Vikas, Saksham, Abhilash, Arka Meghali, US-3140 and Hisar Lalit. These results are in conformity with Das *et al.* (2012) [6] and Mehta and Asati, (2008) [11]. Significant difference among genotypes for the total soluble solid content of fruit at the marketable stage was noticed. TSS of fruit ranged from 2.52 to 7.69°Brix. The highest TSS content of fruit was recorded with the genotype EC 620383. The genotypes showed high TSS greater than mean are BBWR-11-1, EC 620533, Punjab Varkha Bahar-2, EC 620516 and US-1196. These genotypes can be used for processing purpose. These results are in conformity with the finding of Swaroop and Suryanarayana (2005) [15] and Ahmed *et al.*, (2007) [3]. The acidity of the fruits at the marketable stage was ranged from 0.56 to 0.80. The ascorbic acid content of fruit at marketable stage ranged from 15.05 to 31.37. These results are in conformity with findings of Shashikanth *et al.*, (2010) [13] and Manna and Paul, (2012) [10]. In the present investigation possessed, that the results showed a significant

difference among the material assessed for all the traits. of this vegetable crop.
Hence there is a great possibility of improvement in attributes

Table 2: Mean performance of tomato genotypes

	Genotypes	Plant height (cm)	No. of branches/ plant	Days to 50% flowering	No. of flowers per cluster	No. of fruits /plant	Avg. fruit weight (g)	No. of fruits per truss
1.	Palam Pride	76.13	6.00	31.66	8.933	23.06	35.69	2.60
2.	Palam Pink	90.26	5.73	31.00	7.73	26.80	30.94	2.93
3.	EC 620445	87.53	6.86	32.33	7.93	29.80	27.05	3.16
4.	BBWR-11-1	61.93	9.06	30.00	8.06	40.53	24.90	4.63
5.	BBWR-18-17	65.06	7.06	29.33	6.66	23.86	29.22	3.37
6.	EC 620533	117.9	6.86	32.00	8.20	28.80	31.47	2.52
7.	EC 620534	61.13	6.40	33.33	6.73	19.53	32.21	2.61
8.	EC 620378	68.66	5.80	30.66	7.06	20.66	27.57	3.61
9.	EC 620383	57.33	5.73	34.33	9.66	24.86	29.28	2.99
10.	EC 620380	112.5	7.33	32.00	8.73	23.53	40.26	2.31
11.	EC 620391	68.20	4.84	29.66	9.00	26.03	22.07	4.43
12.	BBWR-10-3-17	70.00	5.73	33.66	5.86	19.66	30.29	3.35
13.	BBWR-10-3-18	84.53	9.33	31.66	9.13	23.86	30.15	3.56
14.	Punjab Varkha Bahar-2	77.40	5.93	30.33	6.06	30.06	28.70	3.73
15.	Hisar Arun	71.80	6.13	28.00	6.93	30.13	27.92	3.93
16.	Punjab Chhuhara	73.46	5.36	30.66	6.86	22.00	32.91	3.71
17.	EC 620516	64.33	6.30	30.33	8.53	30.06	26.57	5.36
18.	EC 620536	59.66	5.06	30.66	9.26	19.66	27.80	3.86
19.	Arka Vikas	75.66	5.93	31.33	7.33	27.20	32.57	2.65
20.	Saksham	127.4	8.06	33.33	10.20	24.06	43.59	2.16
21.	Abhilash	81.20	6.53	34.00	8.33	23.33	34.96	2.79
22.	Arka Meghali	70.80	6.40	31.66	6.86	23.40	38.38	2.75
23.	US1196	72.53	4.93	29.33	8.73	24.53	29.76	2.66
24.	US 3140	130.3	5.73	29.66	10.06	20.93	46.27	2.77
25.	DVRT 2	130.3	6.80	29.66	10.06	34.60	46.27	4.39
26.	S-12	63.33	6.33	31.33	6.53	30.60	21.51	5.84
27.	Hisar Lalit	65.20	7.13	29.66	7.40	22.20	37.81	3.73
	Mean	79.19	6.42	31.32	8.01	25.69	31.49	3.42
	SE (d)	3.20	0.25	0.49	0.27	0.96	1.19	0.16
	CD at 5%	9.09	0.71	1.39	0.78	2.75	3.39	0.47

Table 2: (contd.): Mean performance of tomato genotypes

	Genotypes	No. of flower clusters/ plant	Diameter of fruit		No. of locules/fruit	Fruit yield/ plant (g)	TSS	Acidity (%)	Ascorbic acid (mg)
			Polar	Equatorial					
1.	Palam Pride	9.06	4.57	4.09	2.86	821.00	4.08	0.67	25.33
2.	Palam Pink	9.13	4.01	4.19	3.57	828.00	3.98	0.62	26.09
3.	EC 620445	9.13	4.87	4.08	5.03	804.33	5.20	0.56	17.20
4.	BBWR-11-1	8.73	3.39	2.68	4.60	943.13	6.22	0.66	15.05
5.	BBWR-18-17	7.06	4.23	3.91	2.86	702.33	6.06	0.73	19.00
6.	EC 620533	11.40	4.98	4.21	3.33	905.67	3.91	0.59	28.85
7.	EC 620534	7.46	5.17	4.13	2.95	624.00	7.45	0.67	26.98
8.	EC 620378	5.73	4.22	3.93	6.13	571.00	6.16	0.65	31.16
9.	EC 620383	8.33	3.78	4.30	4.13	723.33	7.69	0.72	20.86
10.	EC 620380	10.20	5.13	4.18	4.13	919.00	6.14	0.76	31.37
11.	EC 620391	5.86	3.48	2.94	4.20	572.00	6.39	0.73	24.03
12.	BBWR-10-3-17	5.86	4.67	4.15	3.06	594.00	6.39	0.71	19.64
13.	BBWR-10-3-18	6.66	3.90	4.73	2.70	715.26	5.12	0.77	23.06
14.	Punjab Varkha Bahar-2	8.06	4.46	4.22	5.20	862.66	5.30	0.80	26.07
15.	Hisar Arun	7.80	3.71	4.32	5.46	840.66	4.91	0.68	22.47
16.	Punjab Chhuhara	5.93	4.36	3.09	3.26	716.73	5.13	0.72	23.60
17.	EC 620516	5.60	3.49	4.12	3.66	798.33	6.06	0.66	18.67
18.	EC 620536	5.40	2.52	3.01	9.26	495.73	2.52	0.69	16.93
19.	Arka Vikas	10.33	3.38	4.35	4.79	885.00	4.79	0.64	22.29
20.	Saksham	11.13	5.00	4.01	4.86	1045.2	5.19	0.59	29.30
21.	Abhilash	8.40	4.61	3.94	3.46	814.00	4.25	0.68	23.80
22.	Arka Meghali	8.53	4.36	5.06	6.38	898.00	4.79	0.77	25.32
23.	US1196	9.20	3.93	3.60	6.68	727.00	6.68	0.70	23.60
24.	US 3140	7.53	4.43	5.01	4.98	969.00	4.98	0.74	19.63

25.	DVRT 2	7.93	4.43	5.01	4.98	1049.6	3.77	0.68	24.14
26.	S-12	5.26	2.36	2.84	3.86	659.00	3.76	0.67	27.11
27.	Hisar Lalit	5.93	3.74	4.45	4.26	833.66	5.10	0.66	23.12
	Mean	7.84	4.15	3.99	4.26	789.54	5.26	0.68	23.50
	SE (d)	0.26	0.10	0.07	0.28	15.16	0.12	0.01	0.63
	CD at 5%	0.74	0.29	0.20	0.81	43.04	0.34	0.05	1.80

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