

Performance of tomato (*Solanum lycopersicum* L) genotypes for yield and quality traits under mid-hills of Himachal Pradesh

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ABSTRACT

The experiment was conducted to evaluate the performance of fifty six genotypes of tomato collected from different places of India for yield and quality traits during Kharif season of 2014. Among the genotypes used for evaluation 97/754 was the earliest (72.67 days) and EC-538146 had the highest number of fruits per cluster (4.87). Highest number of fruits per plant was recorded in EC-126903. Solan Tomato-1 was having highest average fruit weight (88.13 g); KS-254 gave highest yield per plant (2033.25 g); Best of All was having highest lycopene content (13.26 mg/100 g); TSS was maximum in KS-254; highest pericarp thickness was observed in Punjab Ratta (6.19 mm); plant height was found maximum in KS-254 (123.27 cm) and less number of locules per fruit was observed in EC-5863. Based on their performance the genotypes VL-Tamatar 4, KS-254, Solan Tomato-1, Solan Tomato-2, EC-620410, Punjab Ratta, Punjab Chhuhara and VTG-93 were found superior than check cultivar Solan Lalima. Therefore these genotypes can be used as such or can further be subjected to selection or heterosis breeding to get the desirable variety of tomato suitable for mid-hills of Himachal Pradesh.

Keywords: Tomato; genotypes; performance; evaluation; quality; yield

INTRODUCTION

Tomato (*Solanum lycopersicum* L.) is one of the world's largest grown vegetable crops after potato and sweet potato. It belongs to the family Solanaceae and is native of Andean region that includes

parts of Colombia, Ecuador, Peru, Bolivia and Chile (Rick 1973, Taylor 1986). In India it occupies an area of 8.82 lakh hectares with a production of 18.74 million MT with an average yield of 21.2 MT per hectare. Himachal Pradesh is one of the major off-season tomato growing states

covering an area of 10.37 thousand hectares with a production of 4.31 lakh MT and an average yield of 41.54 MT per hectare (Anon 2015). Based on its nutritive value and presence of lycopene and flavonoids it is mostly considered as 'protective food' (Sepat et al 2013).

The crop has wide acceptance among hill farmers due to its high market value and constant demand throughout the year. Farmers fetch remunerative return by sending their produce to the plains from June to September as this is the lean period of tomato production in plains due to prevalence of high temperature and rainfall along with the occurrence of leaf curl disease which makes crop cultivation very difficult during this period.

Considering the importance of this crop there is a need for improvement and development of varieties suitable for different agro-ecological conditions with specific end use. But before coming out with any superior variety with better yield and quality traits there is need to periodically check the performance of available germplasm in comparison to best performing variety of that agro-climatic region.

Therefore the present study was undertaken to evaluate the performance of fifty six genotypes of tomato for yield and quality traits under mid-hill conditions of Himachal Pradesh.

MATERIAL and METHODS

The experimental material consisting of 56 tomato genotypes collected from various sources (Table 1) was evaluated at the experimental farm of the Department of Vegetable Science, Dr YS Parmar University of Horticulture and Forestry, Nauni, Solan, HP during 2014-2015. The experiment was laid out in randomized block design with three replications at spacing of 90 × 30 cm. The observations were recorded for 15 characters viz days to first picking, plant height, inter-nodal distance, number of fruits per cluster, number of fruits per plant, average fruit weight, fruit yield per plant, number of locules per fruit, locular wall thickness, pericarp thickness, 1000-seed weight, total soluble solids, lycopene content, fruit shape index and harvest duration in five randomly selected plants from each genotype in each replication. The statistical analysis of the data was carried out using SPAR 1.0 statistical package of Indian Agriculture Statistical Research Institute, New Delhi. The mean values of data were subjected to analysis of variance as described by Gomez and Gomez (1983).

RESULTS and DISCUSSION

The analysis of variance for the experimental design indicated highly significant differences among the genotypes for all the traits studied and data are

Tomato genotypes performance

Table 1. Tomato genotypes and their source

Genotype	Source	Genotype	Source
EC-5205	IIVR, Varanasi	Solan Lalima	UHF, Nauni, Solan
EC-521079	IIVR, Varanasi	97/754	UHF, Nauni, Solan
EC-5863	IIVR, Varanasi	Arka Abha	IIHR, Bangalore
EC-538146	IIVR, Varanasi	Arka Alok	IIHR, Bangalore
EC-521038	IIVR, Varanasi	Arka Saurabh	IIHR, Bangalore
EC-526146	IIVR, Varanasi	Arka Meghali	IIHR, Bangalore
EC-531804	IIVR, Varanasi	Arka Vikas	IIHR, Bangalore
EC-129604	IIVR, Varanasi	VRT-87	VPKAS, Almora
EC-531803	IIVR, Varanasi	VL-Tamatar 4	VPKAS, Almora
EC-620398	IIVR, Varanasi	VTG-93	VPKAS, Almora
EC-620378	IIVR, Varanasi	Punjab Varkha Bahar-2	PAU, Ludhiana
EC-126903	IIVR, Varanasi	Punjab Ratta	PAU, Ludhiana
EC-620424	IIVR, Varanasi	Punjab Tropic	PAU, Ludhiana
EC-620383	IIVR, Varanasi	Punjab Upma	PAU, Ludhiana
EC-392693	IIVR, Varanasi	Castle Rock	PAU, Ludhiana
EC-620396	IIVR, Varanasi	Punjab Kesri	PAU, Ludhiana
EC-620434	IIVR, Varanasi	Punjab Chhuhara	PAU, Ludhiana
EC-620410	IIVR, Varanasi	Rodade	RHRS, Bajaura
EC-535580	IIVR, Varanasi	EC-2491	RHRS, Bajaura
Palam Pride	CSKHPKV, Palampur	EC-164660	RHRS, Bajaura
BT-12	OUAT, Bhubaneshwar	Best of All	IARI, Katrain
BT-18	OUAT, Bhubaneshwar	Roma	IARI, Katrain
BC-333-1	UHF, Nauni, Solan	Marglobe	IARI, Katrain
DC-1	UHF, Nauni, Solan	S-12	PAU, Ludhiana
S-208	UHF, Nauni, Solan	HADT-294	CHES, Ranchi
UHF-II	UHF, Nauni, Solan	KS-254	CSAUAT, Research Station, Kalyanpur
Solan Tomato-1	UHF, Nauni, Solan		
Solan Tomato-2	UHF, Nauni, Solan	KS-7	CSAUAT, Research Station, Kalyanpur
Solan Tomato-3	UHF, Nauni, Solan		

presented in Table 2. The character-wise mean performance of different genotypes is presented in Table 3.

Days to first picking

The observation ranged from 72.67-85.33 days and mean values for different genotypes revealed that 97/754 was the earliest (72.67 days) for first picking which was statistically at par with EC-521079 (74 days), EC-531803 (74 days),

KS-7 (74 days), check variety Solan Lalima (75.33 days), EC-5863 (75.33 days), Arka Vikas (75.33 days), Solan Tomato-1 (75.67 days), KS-254 (75.67 days) and Punjab Kesri (75.67 days). Maximum days were taken in EC-521038 (85.33 days) which was statistically at par with EC-620398 (84.33 days), Punjab Varkha Bahar-2 (84.33 days), EC-620424 (83.67), Roma (83.67 days), Marglobe (83.67 days), Arka Meghali (82.67 days),

Table 2. Analysis of variance (mean sum of square) for different characters

Character	Replication (df= 2)	Genotype (df= 55)	Error (df= 110)
Days to first picking	78	27.91**	4.055
# fruits/cluster	0.007	1.47**	0.132
# fruits/plant	20.956	514.73**	3.267
Average fruit weight (g)	0.501	1077.09**	2.049
Plant height (cm)	437.032	1688.58**	150.089
Inter-nodal distance (cm)	1.391	2.878**	0.622
Pericarp thickness (mm)	1.242	2.094**	0.231
Locular wall thickness (mm)	0.023	1.684**	0.125
# locules/fruit	0.446	2.043**	0.213
Total soluble solids (°B)	0.60	1.111**	0.169
1000-seed weight (g)	0.018	0.461**	0.043
Lycopene content (mg/100 g)	1.322	13.593**	0.353
Harvest duration (days)	27.810	85.603**	10.446
Yield/plant (g)	31680.59	734931.30**	5543.22

**Significant at 5% level, df= Degrees of freedom

Arka Alok (82.67 days), EC-620434 (82.67 days) and EC-620378 (82.33 days).

Number of fruits per cluster

Data recorded on number of fruits per cluster showed significant variation among all genotypes. Its value ranged from 1.84-4.87. Comparison of mean values of the genotypes depicted maximum number of fruits per cluster (4.87) in EC-538146 which was statistically superior to all other genotypes except EC-535580 (4.62), S-208 (4.62) and the check variety Solan Lalima (4.47).

However minimum number of fruits per cluster (1.84) was recorded in VRT-87 which was statistically at par with HADT-294 (1.91), Punjab Tropic (2.05), Punjab Varkha Bahar-2 (2.08), Marglobe

(2.19), Arka Alok (2.20), EC-531803 (2.22), KS-7 (2.26), EC-5205 (2.34), UHF-II (2.41), Solan tomato-2 (2.42) and Arka Abha (2.43).

Number of fruits per plant

Range of data recorded for number of fruits per plant lied between 11.47 and 64.78. Comparison of data recorded on number of fruits per plant showed that the genotype EC-126903 had maximum number of fruits per plant (64.78) which was statistically at par with EC-535580 (64.07) and minimum number of fruits per plant (11.47) was recorded in the genotype EC-620398 which was statistically at par with EC-620434 (11.62), UHF-II (12.25) and Punjab Tropic (13.58). However 33.87 fruits per plant were recorded in the check variety Solan Lalima.

Tomato genotypes performance

Table 3. Mean performance of tomato genotypes for different traits

Genotype	DFP	NFPC	NFPP	AFW	YPP	ID	PT	LWT	PH	TSS	TSW	LC	HD	NLPF
EC-5205	79.00	2.34	15.20	28.85	438.50	4.67	2.74	1.61	59.47	4.23	3.08	3.70	26.33	4.20
EC-521079	74.00	3.20	54.80	17.67	967.68	6.53	2.63	1.53	96.33	4.15	2.55	3.29	28.67	3.13
EC-5863	75.33	3.51	35.47	19.40	690.95	6.48	2.83	1.45	116.67	4.81	3.54	3.34	34.33	2.00
EC-538146	77.67	4.87	51.78	20.67	1071.13	5.47	3.34	1.80	83.60	4.33	3.29	4.93	27.00	2.20
EC-521038	85.33	2.87	22.50	25.83	583.17	5.46	4.23	2.58	76.93	4.14	2.56	3.79	25.67	2.07
EC-526146	80.67	3.51	25.60	18.53	474.89	5.27	2.62	1.58	82.47	4.03	3.19	8.03	23.67	3.53
EC-531804	81.67	3.15	22.87	32.33	740.56	6.09	4.00	1.90	85.10	4.09	2.83	2.73	29.00	2.72
EC-129604	78.67	3.97	60.40	16.60	1003.76	5.84	2.90	1.54	95.80	4.02	2.77	5.49	29.33	3.13
UHF-11	81.33	2.41	12.25	45.03	550.67	6.48	3.87	4.28	120.83	5.54	2.52	3.29	26.67	2.51
EC-531803	74.00	2.22	15.28	19.53	298.99	3.60	2.88	1.80	62.00	4.57	2.61	2.36	26.33	3.13
EC-620398	84.33	2.65	11.47	64.47	738.51	6.12	4.98	3.78	87.27	3.72	3.18	5.01	25.33	4.83
EC-620378	82.33	3.01	21.20	42.33	896.88	5.34	5.80	4.17	73.77	5.09	2.76	6.06	21.00	2.27
EC-126903	79.00	3.97	64.78	8.33	539.06	4.93	2.01	1.65	88.83	4.99	2.54	7.42	25.67	3.00
EC-620424	83.67	3.04	21.53	46.73	1005.15	5.85	5.18	3.19	67.87	4.53	2.75	6.53	24.67	2.67
EC-620383	80.33	3.46	28.19	44.93	1269.55	5.78	4.99	2.42	81.20	4.60	2.95	11.20	22.00	3.20
EC-392693	80.33	4.03	38.38	23.13	887.36	5.20	3.26	1.66	100.43	4.21	2.70	5.18	33.33	2.93
EC-620396	81.67	2.68	20.87	47.27	985.60	4.00	5.49	3.38	54.00	4.57	2.59	5.59	23.33	2.60
EC-620434	82.67	3.13	11.62	22.53	261.25	4.03	4.44	2.30	54.57	4.62	3.08	5.94	18.00	2.80
Palam Pride	77.67	2.68	28.11	35.80	1007.16	4.31	3.88	2.24	63.93	4.08	2.42	6.27	28.33	3.47
BT-18	80.33	3.52	41.27	28.40	1169.75	6.44	4.01	2.24	120.53	3.88	2.77	5.55	23.33	3.07
BC-333-1	79.33	3.75	46.75	26.27	1229.32	4.77	3.23	1.70	97.97	3.95	2.36	6.40	25.00	3.27
DC-1	80.00	2.95	37.00	35.27	1303.00	3.79	3.29	1.48	55.00	3.03	2.89	3.51	22.00	4.00
BT-12	78.00	3.51	27.33	31.48	860.88	3.99	4.25	1.94	53.63	4.25	3.04	3.30	23.67	2.07
EC-620410	80.00	3.24	30.22	62.73	1897.24	4.58	4.37	3.73	70.37	3.95	2.52	3.01	16.33	3.00
EC-535580	76.00	4.62	64.07	16.47	1053.67	5.51	2.86	2.03	99.30	4.66	2.48	1.25	28.00	3.20
S-208	76.00	4.62	57.73	20.53	1186.65	5.25	3.66	1.70	117.80	4.51	3.49	4.49	28.67	2.73
97/754	72.67	3.33	31.13	33.27	1036.09	6.15	4.41	2.52	94.67	4.17	3.00	4.74	24.67	3.53
HADT-294	79.67	1.91	21.93	56.02	1227.77	5.64	3.70	1.93	58.73	4.73	2.10	4.72	26.33	4.87
Punjab Ratta	76.33	2.65	23.40	78.60	1839.08	5.98	6.19	3.63	69.47	5.50	2.78	8.91	21.67	2.53
KS-7	74.00	2.26	21.63	36.60	791.27	3.83	3.17	2.12	38.23	3.07	1.88	3.08	26.00	4.80
VRT-87	79.33	1.84	25.27	33.59	849.42	4.81	3.86	2.18	57.23	4.17	2.26	3.84	20.67	5.13
Punjab Varkha Bahar-2	84.33	2.08	20.23	22.43	453.98	3.97	3.71	3.00	50.10	4.11	2.63	8.28	18.00	4.82

Punjab Tropic S-12	81.67	2.05	13.58	28.16	381.90	3.79	4.27	2.23	52.33	4.17	2.48	6.82	17.33	3.96
Punjab Upma	76.33	2.58	30.53	32.47	992.88	4.15	3.60	1.62	62.63	4.71	2.88	5.69	25.67	3.13
Castle Rock	77.00	3.29	26.43	25.84	684.28	5.52	3.91	2.17	43.83	4.67	1.84	5.53	23.67	2.87
Punjab Kesri	78.33	3.36	21.16	22.93	484.28	4.19	3.41	2.00	53.87	4.15	2.76	4.59	28.67	2.73
Punjab Chuhara	75.67	2.54	30.40	38.93	1183.44	4.54	3.30	2.16	59.43	4.23	3.14	5.26	29.67	4.40
Arka Abha	81.00	3.48	39.27	47.93	1881.16	5.69	4.91	4.12	67.27	3.93	3.33	3.33	28.33	2.33
Arka Saurabh	78.67	2.43	32.20	50.40	1622.12	4.91	3.79	2.45	67.45	4.33	3.35	6.20	25.67	4.00
Arka Meghali	77.00	2.62	24.27	42.24	1024.47	4.85	3.11	1.78	74.83	3.37	2.80	9.52	25.33	4.47
Arka Vikas	82.67	2.58	23.20	54.07	1255.55	4.41	3.79	2.14	48.67	4.73	3.25	5.89	20.33	4.53
Arka Alok	75.33	2.64	42.20	42.93	1809.88	5.52	3.48	2.61	67.80	4.64	2.59	3.49	33.33	4.00
Rodade	82.67	2.20	17.08	46.83	801.17	4.18	3.85	3.18	59.13	3.41	3.27	5.58	26.67	3.70
EC-2491	78.33	3.05	40.93	26.73	1093.72	5.74	3.77	2.39	69.77	4.29	2.75	5.54	27.67	2.20
EC-164660	81.00	3.59	36.27	46.47	1687.08	5.26	3.89	3.05	93.23	4.00	3.16	3.92	32.00	3.15
Best of All	79.00	3.24	47.40	36.54	1731.36	5.74	3.52	1.90	110.37	4.18	3.06	5.35	32.67	3.13
Roma	79.33	2.96	32.84	27.68	909.75	8.16	3.18	1.97	108.70	5.26	2.44	13.26	31.00	3.37
Marglobe	83.67	3.16	30.80	41.13	1265.43	4.54	5.15	3.19	78.83	5.13	3.17	5.73	33.33	2.20
VTG-93	83.67	2.19	22.52	79.32	1785.19	5.70	4.23	2.90	100.47	4.63	3.44	4.61	35.00	4.58
KS - 254	77.67	3.07	26.00	76.87	1998.33	6.73	3.36	2.15	119.00	5.22	3.01	4.54	30.67	3.40
VL - Tamatar 4	75.67	3.16	39.27	51.80	2033.25	6.89	4.25	2.66	123.27	6.42	2.20	5.37	45.00	3.13
Solan Lalima	76.00	3.06	24.40	74.80	1824.61	6.18	3.73	3.07	119.33	4.12	2.66	5.78	39.00	3.33
Solan Tomato -1	75.33	4.47	33.87	52.73	1784.79	7.21	4.86	1.62	119.80	3.27	3.23	7.29	34.00	2.42
Solan Tomato -2	75.67	3.86	22.20	88.13	1954.48	5.77	4.48	2.53	107.60	4.53	2.83	3.49	32.33	3.47
Solan Tomato -3	80.67	2.42	22.52	84.67	1905.66	5.61	4.68	3.26	73.47	3.90	2.27	3.91	27.67	3.73
CD _{0.05}	77.00	2.61	34.67	34.07	1180.44	5.84	4.08	2.57	74.47	4.85	2.50	4.28	30.33	4.00
CV	3.26	0.59	2.93	2.32	120.64	1.28	0.78	0.57	19.85	0.67	0.34	0.96	5.24	0.75
	2.55	11.85	5.87	3.62	6.66	14.86	12.39	14.68	15.28	9.42	7.42	11.24	11.92	13.92

DFF= Days to first picking, NFPC= Number of fruits/cluster, NFPP= Number of fruits/plant, AFW= Average fruit weight (g), PH= Plant height (cm), ID= Internodal distance (cm), PT= Pericarp thickness (mm), LWT= Locular wall thickness (mm), NLPF= Number of locules/fruit, TSS= Total soluble solids (°B), TSW= 1000-seed weight (g), LC= Lycopene content (mg/100 g), HD= Harvest duration (days)

Average fruit weight

Range of data recorded for average fruit weight lied between 8.33 and 88.13 g. The perusal of data presented in Table 3 reveal that the maximum average fruit weight (88.13 g) was observed in Solan Tomato-1 which was superior to all the other genotypes while the minimum value for average fruit weight was recorded in EC-126903 (8.33 g). Average fruit weight of 52.73 g was recorded in the check variety Solan Lalima.

Yield per plant

The observations recorded on fruit yield per plant showed significant variation among various genotypes. It ranged from 261.25 to 2033.25 g. Genotype KS-254 recorded highest yield per plant (2033.25 g) which was statistically at par with VTG-93 (1998.33 g) and Solan Tomato-1 (1954.48 g). Minimum yield per plant (261.25 g) was recorded in EC-620434 which was statistically at par with EC-531803 (298.99 g) and Punjab Tropic (381.90 g). Check variety Solan Lalima recorded yield per plant of 1784.79 g. Yield per plant was in agreement with findings of Sharma and Thakur (2008).

Inter-nodal distance

Significant variation was observed among the genotypes for inter-nodal length. It ranged from 3.60 to 8.16 cm. The genotype EC-531803 recorded lowest inter-nodal length (3.60 cm) and was statistically at par with genotypes DC-1

(3.79 cm), Punjab Tropic (3.79 cm), KS-7 (3.83 cm), Punjab Varkha Bahar-2 (3.97 cm), BT-12 (3.99 cm), EC-620396 (4 cm), EC-620434 (4.03 cm), Palam Pride (4.31 cm), S-12 (4.15 cm), Arka Alok (4.18 cm), Castle Rock (4.19 cm), Arka Meghali (4.41 cm), Roma (4.54 cm), Punjab Kesri (4.54 cm), EC- 620410 (4.58 cm), EC-5205 (4.67 cm), BC-333-1 (4.77 cm), VRT-87 (4.81 cm) and Arka Saurabh (4.85 cm). Genotype Best of All showed highest inter-nodal length (8.16 cm) and it was found statistically at par with the check variety Solan Lalima (7.21 cm) and KS-254 (6.89 cm).

Pericarp thickness

Pericarp thickness ranged from 2.01 to 6.19 mm. Maximum pericarp thickness (6.19 mm) was recorded in Punjab Ratta which was statistically at par with EC-620378 (5.80 mm) and EC-620396 (5.49 mm) while minimum was recorded in EC-126903 (2.01 mm) which was also statistically at par with EC-526146 (2.62 cm), EC-521079 (2.63 cm) and EC-5205 (2.74 cm). The check cultivar Solan Lalima had the pericarp thickness of 4.86 mm.

Locular wall thickness

Locular wall thickness ranged between 1.45 and 4.28 mm. Maximum locular wall thickness (4.28 mm) was observed in UHF-II which was statistically at par with EC-620378 (4.17 mm), Punjab Chhuhara (4.12 mm), EC-620398 (3.78

mm) and EC-620410 (3.73 mm) and minimum of 1.45 mm was observed in EC-5863 which was statistically at par with DC-1 (1.48 mm), EC-521079 (1.53 mm), EC-129604 (1.54 cm), EC-526146 (1.58 mm), EC-5205 (1.61 mm), check variety Solan Lalima (1.62 mm), S-12 (1.62 mm), EC-126903 (1.65 mm), EC-392693 (1.66 mm), BC-333-1 (1.70 mm), S-208 (1.70 mm), Arka Saurabh (1.78 mm), EC-538146 (1.80 mm), EC-531803 (1.80 mm), EC-164660 (1.90 mm), EC-531804 (1.90 mm), HADT-294 (1.93 mm), BT-12 (1.94 mm), Best of All (1.97 mm) and Castle Rock (2 mm).

Number of locules per fruit

EC-5863 had the lowest number of locules per fruit (2.00) which was statistically at par with EC-521038 (2.07), BT-12 (2.07), EC-538146 (2.20), Rodade (2.20), EC-620378 (2.27), Punjab Chhuhara (2.33), check variety Solan Lalima (2.42), UHF-11 (2.51), Punjab Ratta (2.53), EC-620396 (2.60), EC-620424 (2.67), EC-531804 (2.72), S-208 (2.73) and Castle Rock (2.73). Maximum number of locules per fruit (5.13) was recorded in VRT-87 which was statistically at par with HADT- 294 (4.87), EC-620398 (4.83), Punjab Varkha Bahar-2 (4.82), KS-7 (4.80), Marglobe (4.58), Arka Meghali (4.53), Arka Saurabh (4.47) and Punjab Kesri (4.40).

Plant height

Maximum plant height (123.27 cm) was recorded in KS-254 which was

statistically at par with UHF-II (120.83 cm), BT-18 (120.53 cm), check variety Solan Lalima (119.80 cm), VL-Tamatar 4 (119.33 cm), S-208 (117.80 cm), EC-5863 (116.67 cm), EC-164660 (110.37 cm), Best of All (108.70 cm) and Solan Tomato-1 (107.60 cm). Minimum plant height (38.23 cm) was recorded in KS-7 which was also statistically at par with Punjab Upma (43.83 cm), Arka Meghali (48.67 cm), Punjab Varkha Bahar-2 (50.10 cm), Punjab Tropic (52.33 cm), BT-12 (53.63 cm), Castle Rock (53.87 cm), EC-620396 (54 cm), EC- 620434 (54.57 cm), DC-1 (55 cm) and VRT-87 (57.23 cm).

Total soluble solids (°B)

Maximum total soluble solids (6.42°B) were recorded in KS-254 while minimum (3.03°B) in DC-1 which was statistically at par with KS-7 (3.07°B), check variety Solan Lalima (3.27°B), Arka Saurabh (3.37°B) and Arka Alok (3.41°B). One per cent increase in TSS content of fruits results in 20 per cent increase in recovery of processed product (Berry et al 1988). Similar results were also reported by Prema et al (2011) and Kumar et al (2014).

1000-seed weight

The data revealed highly significant differences among the genotypes for 1000-seed weight. The genotype EC-5863 recorded maximum 1000-seed weight (3.54 g) which was statistically at par with S-208 (3.49 g), Marglobe (3.44 g), Arka Abha (3.35 g), Punjab Chhuhara (3.33 g), EC-

Tomato genotypes performance

Table 4. Categories of genotypes based on fruit shape index values

Fruit shape index value	Shape	Genotype
1 and above	Oval	KS-254, EC-2491, Roma, Rodade, Punjab Chhuhara, EC-538146, EC-531803, EC-620378, EC-620424, EC-620396, EC-620434, BT-18, BT-12, EC-620410, Punjab Ratta
0.86-0.99	Spherical	VTG-93, Marglobe, VL-Tamatar 4, EC-164660, Solan Lalima, Best of All, Arka Alok, EC-5863, EC-521038, EC-531804, EC-129604, UHF-11, EC-126903, EC-620383, EC-392693, Solan Tomato-2, BC-333-1, DC-1, Solan Tomato-1, EC-535580, Solan Tomato-3, S-208, 97/754, Punjab Tropic, Punjab Upma, Castle Rock
0.71-0.85	Flat round	Arka Vikas, Arka Meghali, Arka Saurabh, Arka Abha, Punjab Kesri, EC-5205, EC-521079, EC-526146, EC-620398, Palam Pride, HADT-294, KS-7, VRT-87, Punjab Varkha Bahar-2, S-12

538146 (3.29 g), Arka Alok (3.27 g), Arka Meghali (3.25 g) and Check variety Solan Lalima (3.23 g). The minimum seed weight (1.84 g) was recorded in Punjab Upma which was statistically at par with KS-7 (1.88 g) and HADT-294 (2.10 g).

Lycopene content

The results show that lycopene content ranged between 1.25 and 13.26 mg/100 g and depict that Best of All had maximum (13.26 mg/100 g) and EC-535580 had minimum lycopene content (1.25 mg/100 g) which was statistically at par with EC-531803 (1.36 mg/100 g), VRT-87 (1.84 mg/100 g), EC-620410 (2.01 mg/100 g), KS-7 (2.08 mg/100 g), Solan Tomato-3 (2.28 mg/100 g), EC-521079 (2.29 mg/100 g), UHF-II (2.29 mg/100 g), BT-12 (2.30 mg/100 g) and Punjab Chhuhara (2.33 mg/100 g). However 6.29 mg/100 g of lycopene content was recorded in Solan Lalima.

Harvest duration

Statistical analysis revealed that genotypes showed significant variations for harvest duration. Maximum harvest duration (45 days) was recorded in genotype KS-254 and minimum (16.33 days) in EC-620410 which was found statistically at par with Punjab Tropic (17.33 days), Punjab Varkha Bahar-2 (18 days), EC-620434 (18 days), Arka Meghali (20.33 days), VRT-87 (20.67 days) and EC-620378 (21 days) as against 34 days in check variety Solan Lalima.

Fruit shape index

Maximum fruit shape index value (1.71) was recorded in Punjab Chhuhara which was statistically superior over all the other genotypes whereas minimum (0.76) was observed in Arka Vikas. Fifteen genotypes were found to have oval shape with an index value one and above including the best genotype KS-254 while remaining

forty one genotypes fell under spherical and flat round group with an index value of 0.86-0.99 and 0.76-0.85 respectively. On the basis of fruit shape index value the genotypes were grouped into three categories as presented in Table 4.

CONCLUSION

In the present investigation the genotypes VL-Tamatar 4, KS-254, Solan Tomato-1, Solan Tomato-2, EC- 620410, Punjab Ratta, Punjab Chhuhara and VTG-93 were found superior in terms of yield per plant and other quality traits. So they could further be subjected to selection to isolate desirable genotypes in tomato or can be used in different breeding programmes for the exploitation of heterosis.

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Received: 21.9.2016

Accepted: 16.11.2016