Vegetable Science (2015) 42 (2) : 98-100

Short Communication

Genetic variability in tomato grown in autumn season

S K Jindal and A Khan

Received: June, 2014 / Accepted: August, 2015

Tomato (*Solanum lycopersicum* L.) is a popular vegetable all over the world because of its high nutritive value and versatile uses. It is a rich source of vitamin A and C. It is eaten as salad and cooked as vegetable. It is the second largest crop among the processed vegetables. It is processed into various forms such as juice, ketchup, paste puree etc. In self-pollinated crops like tomato, improvement in yield and quality through hybrid breeding programme depends upon the extent of variability for desirable traits within the available germplasm. Therefore, the estimation of variability parameters for economically important characters is essential to formulate strategies for crop improvement. Variability studies supplemented with knowledge of heritability and genetic advance for a particular character provide information about the possible improvement that can be brought about through selection.

The present investigation was carried out at the Department of Vegetable Science, Punjab Agricultural University, Ludhiana. Forty four F_1 crosses were made in a line x tester fashion by using eleven lines and four testers during February to March of 2010. The experimental material comprising of forty four F_1 hybrids, fifteen parental lines and two checks were sown in nursery beds on 24th July 2010. Transplanting was done in the field on 30th August 2010 in a Randomized Block Design with three replications. In each replication, there were ten plants in a row for each entry. The data were recorded on sixteen characters. Observations were based on five central plants in a row leaving one plant on each side of the row. The genetic variability was assessed by using the parameters like genotypic coefficient variation (GCV), phenotypic coefficient of variation (PCV) heritability and genetic advance. The genotypic and phenotypic coefficients of variation, heritability in broad sense and expected genetic advance were calculated.

Department of Vegetable Science, Punjab Agricultural University, Ludhiana, Punjab-141004

Analysis of variance for experimental design revealed that variance due to replications was very low in magnitude and differences were significant for most of the characters studied except plant height, average fruit weight, number of fruits per plant, harvesting span, pericarp thickness and number of locules per fruit. This showed that the experimental plot was heterogeneous in fertility level. Highly significant differences among genotypes were present for all the characters studied.

The mean values and range for all traits under study are given in Table 1. The maximum value for phenotypic coefficient of variability was observed by lycopene content (41.21%), followed by number of fruits per plant (37.82%), total fruit yield (36.10%), marketable yield (33.82%), average fruit weight (28.63%) and plant height (26.08%). The estimates were moderate for titratable acidity (24.12%), pericarp thickness (22.04%), days to 50% flowering (21.34%) and numbers of locules per fruit (20.53%). The coefficients of phenotypic variation were quite low for ascorbic acid (14.03%) followed by fruit shape index (13.13%), TSS (10.73%), harvesting span (10.04%), days to first harvest (9.75%) and dry matter (9.59%). Character having high phenotypic coefficients of variability was suitable for improvement through selection, because it shows the variability present in the population. Kumari *et al* (2007) observed the highest genotypic coefficient of variation for plant height followed by early yield, lycopene content, number of fruit bearing branches and titratable acidity.

In all the cases, phenotypic coefficient of variability is more than the genotypic coefficient of variability, indicating the role of environment in the expression of the traits under the observation. The character having high genotypic coefficient of variability possessed better potential for improvement through selection. Similar projections have been made by Brar *et al* (1998). Genotypic coefficient of variability was highest for lycopene content (39.98%), followed by number of fruits per plant (36.61%), total fruit yield (34.59%), marketable

Table 1. Mean performance of parents and checks for different characters.

Parent	Days to 50% flowering	Days to first harvest	Plant height (cm)	Average fruit weight (g)	Number of fruits/plant	Total fruit yield (kg/plant)	Marketable yield (kg/plant)	Harvesting span (days)
Line								
PVB-1	26.67	96.00	132.73	47.39	37.75	1.50	1.33	79.00
Sel 12-1-17	20.00	107.67	137.00	73.03	16.13	1.14	0.96	69.50
Sel 12-1-16	21.67	90.67	154.55	58.62	19.76	1.30	1.05	75.33
102-8-6-1	30.00	93.33	77.67	50.37	22.76	1.15	0.90	74.33
102-8-5-1	25.00	80.00	81.43	48.76	27.14	1.55	1.08	80.00
102-1-6-1	24.33	88.00	93.53	65.29	20.63	1.28	1.12	74.33
7-5-1	17.00	88.00	77.45	34.62	44.50	1.16	0.89	79.67
7-4	23.67	84.00	74.60	33.99	43.43	1.42	1.17	82.67
2-1	21.00	88.00	66.80	23.05	23.67	0.60	0.47	82.00
CH-2-2	30.00	102.67	97.80	65.18	12.21	0.71	0.50	59.67
CH-2-3-1	20.33	96.00	105.13	63.30	23.04	1.22	1.04	82.67
Tester								
115-1-8-1	24.00	88.00	75.93	55.41	33.39	1.64	1.35	80.33
58-18-1-1	17.00	76.00	94.00	47.32	25.00	1.02	0.91	73.00
55-26-1-1	26.00	80.00	74.97	55.67	24.42	1.33	1.07	78.00
PVB-2	29.33	107.67	121.27	60.64	21.5	1.34	0.97	84.67
Check								
Punjab Chhuhara	32.00	88.00	46.00	43.15	6.43	0.25	0.20	71.00
NS-524	31.65	107.67	97.03	42.04	30.11	1.26	1.11	84.00
Grand mean	**24.69**	**91.86**	**94.58**	**51.05**	**25.40**	**1.17**	**0.95**	**77.07**
CD at 5%	**4.15**	**6.84**	**12.95**	**3.93**	**4.32**	**0.27**	**0.18**	**6.01**
CD at 1%	**5.46**	**9.00**	**17.04**	**5.17**	**5.68**	**0.35**	**0.24**	**7.91**

Parent	Fruit shape index	Pericarp thickness (cm)	Number of locules per fruit	Dry matter (%)	TSS (%)	Lycopene content (mg/100g)	Titratable acidity (mg/100ml)	Ascorbic acid (mg/100 ml)
Line								
PVB-1	0.89	0.73	2.89	4.43	4.11	2.49	0.68	25.62
Sel 12-1-17	0.89	0.63	2.17	5.81	4.00	4.52	0.80	17.99
Sel 12-1-16	0.86	0.70	2.78	4.41	4.35	4.61	0.78	16.97
102-8-6-1	0.89	0.55	2.78	4.59	3.73	2.80	0.51	19.38
102-8-5-1	0.88	0.77	2.78	4.47	4.40	2.82	0.94	22.93
102-1-6-1	0.91	0.61	2.90	4.59	3.66	3.11	0.54	24.45
7-5-1	1.14	0.41	2.00	5.10	4.87	1.22	0.34	24.95
7-4	1.11	0.44	2.25	4.67	4.09	1.94	0.73	19.06
2-1	1.20	0.36	2.00	4.80	4.10	3.88	0.57	21.66
CH-2-2	0.90	0.81	2.56	4.35	3.50	4.64	0.65	20.39
CH-2-3-1	0.93	0.68	3.23	4.49	4.29	1.38	0.89	20.14
Tester								
115-1-8-1	1.01	0.68	3.00	4.46	3.85	5.50	0.77	16.09
58-18-1-1	0.95	0.45	2.25	4.03	4.28	2.23	0.60	17.23
55-26-1-1	0.92	0.69	3.22	4.37	3.69	2.78	0.96	16.09
PVB-2	0.88	0.75	4.11	4.72	4.19	3.74	0.82	16.47
Check								
Punjab Chhuhara	1.35	0.57	2.89	5.47	4.72	2.80	0.64	18.75
NS-524	0.98	0.77	3.08	4.27	4.19	2.80	0.66	19.51
Grand mean	**0.98**	**0.62**	**2.76**	**4.65**	**4.12**	**3.13**	**0.70**	**19.86**
CD at 5%	**0.06**	**0.07**	**0.41**	**0.36**	**0.33**	**0.49**	**0.08**	**1.48**
CD at 1%	**0.08**	**0.09**	**0.54**	**0.47**	**0.43**	**0.64**	**0.11**	**1.94**

yield (31.42%), average fruit weight (28.23%) and plant height (24.81%). The estimates were moderate for titratable acidity (23.17%), pericarp thickness (20.97%), days to 50% flowering (18.79%) and numbers of locules per fruit (18.75%). Genotypic coefficients of variability were low for ascorbic acid (13.27%) followed by fruit shape index (12.41%), TSS (9.45%), harvesting span (8.86%), days to first harvest (8.85%) and dry matter (8.27%). High genotypic coefficient of variation for fruit weight was earlier reported by Padamalata and Reddy (1990) and Reddy and Reddy (1992). Similarly for yield, high GCV was reported by Padamalata and Reddy (1990) and Das *et al* (1998). Maximum expression of genotypic and phenotypic coefficients of variation for lycopene content have been observed by Bajaj *et al* (1990), and Sharma *et al* (1996).

The estimates of heritability represent a measure of

Table 2. Estimation of mean, range, phenotypic and genotypic coefficients of variation, heritability and genetic advance of different character in tomato.

Character	Mean	Range	PCV	GCV	Heritability (bs)	Genetic advance	Genetic advance over mean (%)	CV
Days to 50% flowering	25.43	16-39	21.34	18.79	77.55	8.67	34.09	10.11
Days to first harvest	91.32	76-107.6	9.75	8.85	77.59	14.22	15.58	4.61
Plant height (days)	99.20	46.00-171.53	26.08	24.81	90.50	48.23	48.62	8.04
Average fruit weight (g)	57.23	23.05-79.75	28.63	28.23	97.24	29.38	57.35	4.76
Number of fruits/plant	27.98	12.21-59.99	37.82	36.61	93.70	20.43	73.00	9.50
Total fruit yield (kg/plant)	1.11	0.25-2.91	36.10	34.59	77.97	12.67	68.27	10.34
Marketable yield (kg/plant)	1.34	0.20-2.53	33.82	31.42	89.36	0.23	60.14	12.50
Harvesting span (days)	78.50	59.67-89.00	10.04	8.86	86.32	0.26	16.12	4.71
Fruit shape index	0.95	0.74-1.34	13.13	12.41	91.79	1.07	24.18	4.28
Pericarp thickness (cm)	0.64	0.36-0.87	22.04	20.97	90.53	0.68	41.11	6.78
Number of locules per fruit	3.03	2.00-5.00	20.53	18.75	83.39	2.53	35.26	8.37
Dry matter (%)	4.62	3.83-5.99	9.59	8.27	74.37	0.33	14.69	4.85
TSS (%)	4.19	3.23-5.21	10.73	9.54	79.14	0.73	17.49	4.90
Lycopene content (mg/100g)	3.12	1.19-7.08	41.21	39.98	94.12	5.29	79.89	9.99
Titratable acidity (mg/100ml)	0.73	0.34-1.21	24.12	23.17	92.31	0.76	45.86	6.69
Ascorbic acid (mg/100ml)	20.44	16.09-26.36	14.03	13.27	89.50	8.67	25.86	4.55

genetic relationship between parent and progeny and are of fundamental importance in the practicability of selection, because it acts as a predictive instrument in expressing the reliability of phenotypic value, thus helping the plant breeder to make selection for a particular character when heritability is high. In present study, high heritability estimates (Table 2) were obtained for average fruit weight (97.24%) followed by lycopene content (94.12%), number of fruits per plant (93.70%), titratable acidity (92.31%), fruit shape index (91.79%), pericarp thickness (90.53%), plant height (90.50%), ascorbic acid (89.50%), marketable yield (89.36%), harvesting span (86.32%) and number of locules per fruit (83.39%), while moderate heritability was reported for TSS (79.14%), total fruit yield (77.97%), days to first harvest (77.59%), days to 50% flowering (77.55%) and dry matter (74.37%). Reddy and Reddy (1992) studied the heritability in tomato and found high heritability for yield/plant (97.99%), early yield/plant (97.06%), number of fruits/plant (95.96%) and average fruit weight (98.46%).

The estimates of expected genetic advance was highest for lycopene content (79.89%) followed by number of fruits per plant (73.02%), total fruit yield (68.27%), marketable yield (60.14%), average fruit weight (57.35%) and plant height (48.62%). The estimates were moderate for titratable acidity (45.86%), pericarp thickness (41.11%), numbers of locules per fruit (35.26%) and days to 50% flowering (34.09%). While low genetic advance were recorded for ascorbic acid (25.86%) followed by, fruit shape index (24.18%), TSS (17.79%), harvesting span (16.12%), days to first harvest (15.58%) and dry matter (14.69%).

The traits having high estimates of heritability coupled with high genetic advance may help in establishing the close relationship between the genotype and phenotype. From the above observation it could be inferred that selection based on lycopene content, number of fruits per plant and average fruit weight would be effective. However, for ascorbic acid, fruit shape index, TSS and harvesting span the heritability estimates were high but coefficients of variability and genetic advance were low, hence selection for these characters would bring about limited improvement.

References

Bajaj K, Mahajan R, Kaur PP and Cheema DS (1990) Chemical evaluation of some tomato varieties. *J Res Punjab agric Univ* 27: 220-30.

Brar GS, Singh S, Cheema DS and Dhariwal MS (1998) Studies on variability, heritability, genetic advance for yield and component characters in tomato (*Lycopersicon esculentum* Mill). *J Res Punjab agric Univ* 37: 190-93.

Das B, Hazarika MH and Das PK (1998) Genetic variability and correlation in fruit characters of tomato (*Lycopersicon esculentum* Mill). *Ann Agric Res* 19: 77-80.

Kumari N, Srivastava JP, Shekhavat AKS, Yadav JR and Singh B (2007) Genetic variability and heritability of various traits in tomato (*Lycopersicon esculentum* Mill). *Prog Agric* 7: 80-83.

Padmalata B and Reddy E (1990) Variability parameters in F_2 generation of tomato. *South Indian Hort* 38: 11-14.

Reddy VVP and Reddy KV (1992) Studies on variability in tomato. *South Indian Hort* 40: 257-60.

Singh HN, Singh RR and Mittal RK (1974) Genotypic and phenotypic variability in tomato. *Indian J Agric Sci* 44: 807-11.

Sharma S, Mahajan R and Bajaj KL (1996) Biochemical evaluation of some tomato varieties. *Veg Sci* 23: 42-47.