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Stability analysis for yield and quality attributes in tomato (*Solanum lycopersicum* L.)

SV Savale and AI Patel

Abstract
To study stability of total 45 genotypes of tomato (32 hybrids + 12 parents + 1 commercial check) under three diverse environments were evaluated in Randomized Block Design (RBD) with three replications. Environment included three locations *viz.*, Navsari (E_1), Surat (E_2) and Hansot (E_3) under the Navsari Agricultural University, Navsari (Gujarat) during late *kharif* 2014-15 to identify the most stable genotypes. The pooled analysis of variances indicated that genotypes x environment interactions were highly significant for fruit yield per plant (kg) and pericarp thickness (mm) and these characters were subjected to stability analysis. Linear as well as non- linear component of G x E interactions were found to be significant for these characters indicating that response of genotypes varied in different environments. In general, all the genotypes did not show any uniform stability and linear pattern for all the traits. In present experiment, the parent *viz.*, AVTO-4 and the hybrids AVTO-6 x GT-2 had high mean value over population mean, closer to one regression coefficient (b_i) and low and non-significant deviation from regression and was highly stable for yield per plant. These genotypes are likely to perform well in all the three environments.

Keywords: Tomato, Stability analysis and G x E interaction

Introduction
Tomato (*Solanum lycopersicum* L.) is one of the most popular and extensively consumed vegetable crops. It tops the list of processed vegetables, as, several items like puree, paste, sauce, ketchup, soup, juice and peeled tomatoes are prepared on a large scale. India is the fourth largest tomato producer in the world after china, USA and Turkey, accounting for about 6.5 % of the world production. In India, it occupies 8.64 lakh ha of total vegetable area and accounts for 168.26 lakh tonnes of total vegetable production and having productivity of 19.6 tonnes ha^{-1} (Anon., 2014) [1]. In Gujarat, tomato is grown in late *kharif* and fresh tomatoes are available for limited period only which are cultivated by Gujarat farmers. Gujarat occupies an area of 38.80 million ha with an annual production of 978.40 million tonnes production and productivity of 25.20 tonnes ha^{-1} (Anon., 2014) [1].
In view of the importance, there is a need to develop genotypes with improved yield and quality. Although a number of hybrids have been recommended for the cultivation, the information on the stability is lacking for agroclimatic conditions of Gujarat. So there is necessity to evaluate and screen the potential genotypes giving consistent performance over different years and to select the genotypes on the basis of stability parameters for important yield and quality attributes (Kalloo *et al.*, 1998) [5].
Unstable performance of released varieties and hybrids is one of the major factors for low productivity. Therefore, it becomes essential to search out the hybrid not only having high yield potential but also a stable performance under varying environmental conditions. The present study is aimed at evaluating potential genotypes for the purpose on the basis of stability parameters for important yield and quality attributes.

Materials and Methods
Present investigation was carried out during late *kharif* 2014 - 2015 at three different locations in south Gujarat conditions *viz.*, Vegetable Research Scheme, Regional Horticulture Research Station (R.H.R.S.), Navsari (Environment E_1); Main Cotton Research Station, Surat (Environment E_2) and Cotton Wilt Research Station, Hansot, Dist. Bharuch (Environment E_3) to evaluate the performance and stability of 45 genotypes comprising of 32 F_1s, 12 parents and 1 commercial check "Abhinav". The experiments were laid in randomized block design with three replications at each location. Each genotype was grown in a single row plot having 10 plants in each row at as pacing of 75 cm x 60 cm. The experimental fields were well prepared and standard recommended package of practices followed to raise a good crop.

Data were recorded for yield and quality attributes on five randomly selected competitive plants. The data were subjected to analysis of variance to list the significance of genotype x environment interactions. Stability parameters, regression (b_i) and deviation from regression (S^2d_i) were worked out by the methods suggested by Eberhart and Russell (1966) [3].

Results and Discussion

The stability analysis (Table 1) indicated that presence of significant G x E interaction for all the characters (except titrable acidity per cent, total sugar per cent and non reducing sugar per cent) under study. Higher magnitude of mean squares due to the environments indicated considerable differences between environments for these characters and that these characters were influenced greatly by environments thereby suggesting that large differences between environments along with the greater part of genotypic response was a linear function of environments *i.e.* the environments created by showing over location was justified and had linear effects. These results are in agreement with the earlier findings of Aravindakumar *et al.* (2003) [2], Dhaduk *et al*. (2004), Prasanna *et al*. (2007) [8], Jyothi *et al.* (2012) [4] and Ummyiah *et al.* (2015) [10].

The variance due to genotype x environment interactions were also significant for fruit yield per plant (kg) and non reducing sugar per cent when tested against pooled deviations. The lack of significant G x E interaction for rest of the characters under study indicated that genotypes responded consistently over the environments for these characters. The results of these characters are not, therefore included in the study.

The variance due to G x E interaction (linear) was further partitioned into two components *viz.*, genotype x environment (linear) and the remainder (non-linear) *i.e.*, pooled deviation. The linear response of genotype to varying environments showed significant mean squares for all the characters (except titrable acidity per cent) indicating significant differences among the genotypes for their regression on environmental indices. Almost identical results have been reported by Aravindakumar *et al.* (2003) [2], Dhaduk *et al*. (2004), Shobha *et al.* (2006) [9] and Ortiz *et al.*, (2007) [7] in tomato. Pooled deviation were significant for the characters like fruit yield per plant (kg) and non reducing sugar per cent when tested against pooled error suggesting that deviation for linear regression also contributed substantially towards the differences in stability of genotypes. However, considerable portion of G x E interactions was attributable to linear components (predictable) for fruit yield per plant (kg), pericarp thickness (mm), total soluble solids (°Brix), ascorbic acid (mg/100g), lycopene content (mg/100g), reducing sugar (%), total sugar (%) and non reducing sugar (%). Thus, linear effects played an important role as compared to non-linear effects in the development of these characters. On the other side, pooled deviation (unpredictable) contributed slightly more to the fruit yield per plant (kg) and non reducing sugar per cent. Thus, this study indicated that both linear and non-linear functions play an important role in building up total G x E interaction. These findings are in agreement with those of Mandal *et al.* (2000) [6], Prasanna *et al*. (2007) [8] and Ummyiah *et al.* (2015) [10].

To assess the stability of genotype regression coefficient (b_i) is considered as parameters of response of a particular genotype and deviation from regression (S^2d_i) as a parameter of stability. Hence, the mean performance of genotypes, along with both parameters *i.e.*, regression coefficient (b_i) and deviation from regression (S^2d_i) were estimated and presented in Table 2 to 4.

According to the model of Eberhart and Russell (1966) [3], a variety may said to be stable over different environments, if it shows unit regression coefficient (b_i = 1.0) with lowest deviation (non-significant) from the linear regression (S^2d_i = 0). With these conditions, high and desirable *per se* performance of variety over environments is also a positive point to rate the variety/hybrid as a better and stable genotype.

A perusal of data in table 2 to 4 indicated that, for fruit yield per plant, among the parents, AVTO-4 was registered high mean value, low S^2d_i value with b_i values nearer to unity while, AVTO-5 showed high mean values, low S^2d_i values with greater than one b_i values. Among the different crosses, AVTO-6 x GT-2 was registered high mean values, low S^2d_i value with b_i values nearer to unity. The cross combination AVTO-7 x GT-2, AVTO-5 x GT-2, AVTO-5 x JT-3, and JTL-12-12 x JT-3 were registered high mean values, greater than one regression coefficient and low S^2d_i value while AVTO-6 x AT-3 registered high mean value, below than one regression coefficient and low S^2d_i value. Parent AT-3 and hybrid AVTO-7 x JT-3 were exhibited high mean value and greater than b_i value with significant deviations from zero hence, were considered as unstable or unpredictable.

For pericarp thickness, among the parents, AVTO-5 showed high mean values, low S^2d_i values with greater than one b_i values. The other parents AVTO-6, AVTO-7, AVTO-4, JTL-12-12 and GT-2 exhibited higher mean with low S^2d_i value and b_i value is greater than one. Among the different crosses, six crosses *viz.*, AVTO-6 x GT-2, AVTO-7 x JT-3, NTL-50 x JT-3, NTL-50 x AT-3, AVTO-5 x Arka Abha and JTL-12-12 x AT-3 were registered high mean values, low S^2d_i value with b_i values nearer to unity. The cross combination JTL-12-12 x JT-3 was registered high mean values, greater than one regression coefficient and low S^2d_i value while, the crosses *viz.*, AVTO-7 x GT-2, AVTO-5 x GT-2 and JTL-12-12 x GT-2 were registered higher mean values, low deviation from regression values and less than one regression coefficients. Hybrids AVTO-7 x AT-3 exhibited high mean value and b_i value nearer to unity and significant deviations from zero, hence were considered as unstable or unpredictable.

For total soluble solids, among the parents, AVTO-5 was registered high mean value, low S^2d_i value with b_i values nearer to unity. While other parent AVTO-7 registered high mean value, low S^2d_i value with b_i value lesser than unity. The genotype AVTO-6 registered higher mean value, b_i value lesser than one with significant S^2d_i value indicated that the genotype was unpredictable. Among the different crosses, AVTO-6 x GT-2 and JTL-12-12 x GT-2 were registered high mean values, greater than one regression coefficient and low S^2d_i value. Hybrids *viz.*, JTL-08-15 x JT-3 was exhibited high mean value with b_i lesser than one with significant deviations from zero and hence were considered as unstable or unpredictable. A commercial check, Abhinav was registered higher mean values and greater than one regression coefficient and low S^2d_i value.

For ascorbic acid, among the parents, AVTO-6, JTL-08- 16 and JTL-08-15 were registered high mean values, low S^2d_i values with greater than one b_i values. A parent AVTO-5 showed high mean values with low S^2d_i values and b_i values less than unity. Among the different crosses, two crosses AVTO-6 x GT-2 and JTL-12-12 x AT-3 were registered high mean values, low S^2d_i value with b_i values nearer to unity. Two cross combination AVTO-6 x Arka Abha and AVTO-5 x GT-2 were registered higher mean values, low deviation from

regression values and less than one regression coefficients. A cross combination JTL-08-16 x Arka Abha was was exhibited high mean value with low S^2d_i value and significant b_i value indicated that this hybrid perform better in favourable environment. A commercial check, Abhinav was registered higher mean values, low S^2d_i value with greater than one b_i values.

Table 1: Analysis of variance for phenotypic stability pertaining to various traits

Source	d. f.	Traits				
		Fruit yield per plant (kg)		Pericarp thickness (mm)	Total soluble solid (ºBrix)	Titrable acidity (%)
Genotypes (G)	44	1.02**++		1.88**++	1.02**++	0.02**++
Environments (E)	2	18.11**++		10.74**++	8.06**++	0.39**++
G x E	88	0.15**+		0.16**++	0.07*+	0.002
Environments (linear)	1	36.23**++		21.48**++	16.11**++	0.77**++
G x E (linear)	44	0.20**++		0.23**++	0.09**++	0.002
Pooled deviation	45	0.09*		0.10	0.04	0.001
Pooled error	264	0.07		0.08	0.05	0.001
Source	d. f.	Traits				
		Ascorbic acid (mg/100g)	Lycopene content (mg/100g)	Total sugar (%)	Reducing sugar (%)	Non reducing sugar (%)
Genotypes (G)	44	18.25**++	1.55**++	1.49**++	0.71**++	0.23**++
Environments (E)	2	134.56**++	9.81**++	51.64**++	24.93**++	5.00**++
G x E	88	1.78*+	0.15**++	0.17	0.13**++	0.07**
Environments (linear)	1	269.12**++	19.61**++	103.28**++	49.86**++	10.00**++
G x E (linear)	44	2.42**++	0.23**++	0.22*++	0.19**++	0.09**++
Pooled deviation	45	1.11	0.08	0.12	0.06	0.04**
Pooled error	264	1.34	0.11	0.11	0.09	0.02

*, ** Significant at 5 % and 1 % level, respectively against pooled error.
+, ++ Significant at 5 % and 1 % level, respectively against pooled deviation.

Table 2: Stability parameters for and fruit yield per plant (kg) and pericarp thickness (mm) for parents and hybrids

Sr. No.	Genotype	Fruit yield per plant (kg)			Pericarp thickness (mm)		
		Mean	b_i	S^2d_i	Mean	b_i	S^2d_i
1	AVTO-6	3.57	0.29	0.12	4.52	1.92	0.00
2	AVTO-7	3.56	0.56*	-0.07	5.15	1.41	-0.07
3	NTL-50	3.82	0.62	-0.06	4.44	1.31	0.09
4	AVTO-4	3.96	1.07	0.09	4.54	1.44	-0.07
5	AVTO-5	4.18	1.38	-0.07	5.19	1.20	-0.06
6	JTL-08-16	3.41	0.92	0.13	4.24	-0.13	0.01
7	JTL-08-15	3.69	0.70**	-0.07	4.52	2.04	-0.01
8	JTL-12-12	3.93	0.76	0.06	5.12	1.41	-0.08
9	Arka Abha	3.08	-0.87	0.45**	3.63	0.68	-0.08
10	GT-2	4.10	1.13	-0.07	5.02	1.69	-0.04
11	JT-3	3.17	0.39	-0.07	4.04	1.11*	0.11
12	AT-3	3.72	1.18	0.46**	3.62	-0.21	-0.08
	Parental mean	3.68			4.50		
13	AVTO-6 x Arka Abha	4.40	0.74	-0.04	5.47	1.17	-0.05
14	AVTO-6 x GT-2	5.24	1.07	-0.06	6.48	0.90	-0.01
15	AVTO-6 x JT-3	4.43	1.27	-0.03	5.48	1.14	0.00
16	AVTO-6 x AT-3	4.78	0.72	0.12	5.43	0.95	-0.07
17	AVTO-7 x Arka Abha	4.43	0.76	-0.06	5.53	0.91	-0.06
18	AVTO-7 x GT-2	5.50	1.80	-0.06	6.83	0.55	-0.05
19	AVTO-7 x JT-3	5.19	1.89	0.37*	5.87	0.94	0.04
20	AVTO-7 x AT-3	4.52	1.03	-0.04	6.15	0.99	0.42*
21	NTL-50 x Arka Abha	4.29	0.93	-0.06	5.50	0.60	-0.07
22	NTL-50 x GT-2	4.68	0.83	0.14	5.62	0.42**	-0.08
23	NTL-50 x JT-3	4.74	0.26	0.17	5.97	0.99	0.12
24	NTL-50 x AT-3	4.56	0.91	0.09	5.90	0.92	0.04
25	AVTO-4 x Arka Abha	4.40	1.09	-0.07	5.54	1.78	-0.01
26	AVTO-4 x GT-2	4.63	1.08	-0.07	5.70	2.39	0.14
27	AVTO-4 x JT-3	4.36	1.32	-0.04	5.57	1.36	0.42*
28	AVTO-4 x AT-3	4.49	0.92	0.03	5.51	1.24	-0.06
29	AVTO-5 x Arka Abha	4.39	0.94	-0.01	5.85	0.98	0.04
30	AVTO-5 x GT-2	5.70	1.77	-0.05	6.92	0.60	-0.05
31	AVTO-5 x JT-3	5.39	1.50	0.03	7.01	0.44	-0.08
32	AVTO-5 x AT-3	4.60	1.08	-0.07	5.84	0.86	0.08
33	JTL-08-16 x Arka Abha	4.23	0.78	-0.07	5.12	-0.04	0.28*
34	JTL-08-16 x GT-2	4.34	0.50	-0.03	5.48	0.95	-0.01
35	JTL-08-16 x JT-3	4.45	0.70	0.21*	5.07	-0.38	0.25*

36	JTL-08-16 x AT-3	4.40	0.73	-0.04	5.21	-0.82**	-0.08
37	JTL-08-15 x Arka Abha	4.25	0.88	-0.04	5.62	1.26	-0.04
38	JTL-08-15 x GT-2	4.33	1.27	-0.04	5.76	2.61	0.09
39	JTL-08-15 x JT-3	4.35	0.88	-0.07	5.88	2.20	-0.01
40	JTL-08-15 x AT-3	4.39	1.41	0.10	5.86	0.77	-0.02
41	JTL-12-12 x Arka Abha	4.33	1.17	0.03	5.84	0.99	-0.06
42	JTL-12-12 x GT-2	5.34	2.01	-0.06	6.85	0.17	-0.05
43	JTL-12-12x JT-3	5.28	1.91	0.02	6.54	1.23	-0.08
44	JTL-12-12 x AT-3	4.52	1.33	-0.06	5.90	0.92	-0.03
45	Abhinav (check)	4.73	1.38	-0.03	5.83	1.15	-0.03
	Hybrid mean	4.65			5.85		

*, ** Significant at 5 per cent and 1 per cent of probability levels, respectively.

Table 3: Stability parameters for total soluble solids (°Brix) and ascorbic acid (mg/100 g) for parents and hybrids

Sr. No	Genotype	Total soluble solids (°Brix)			Ascorbic acid (mg/100 g)		
		Mean	b_i	S^2d_i	Mean	b_i	S^2d_i
1	AVTO-6	3.81	0.81	0.16 *	26.25	1.29	-1.28
2	AVTO-7	3.93	0.69	-0.05	24.25	2.24	20.56 **
3	NTL-50	3.77	0.39	-0.05	25.02	0.60*	-1.36
4	AVTO-4	3.71	0.17	0.03	26.73	0.26	-1.25
5	AVTO-5	3.93	1.00	-0.05	27.44	0.72	-0.51
6	JTL-08-16	3.27	0.37	-0.05	26.92	1.23	1.23
7	JTL-08-15	3.73	0.42	-0.05	26.08	1.10	-0.49
8	JTL-12-12	3.27	-0.39	-0.04	26.06	0.16	-0.85
9	Arka Abha	2.53	0.76	0.05	25.82	0.74*	-1.36
10	GT-2	3.80	0.38	0.00	26.56	0.66	-0.89
11	JT-3	3.14	1.68	-0.05	23.79	0.96	-1.21
12	AT-3	3.37	0.79	-0.05	24.09	0.69	-1.26
	Parental mean	3.52			25.75		
13	AVTO-6 x Arka Abha	4.23	1.03	-0.05	33.57	0.61	-0.06
14	AVTO-6 x GT-2	5.50	1.11	-0.05	32.97	1.07	-0.87
15	AVTO-6 x JT-3	5.02	1.84	-0.03	28.41	1.54	-0.11
16	AVTO-6 x AT-3	4.55	0.81	-0.02	28.66	0.65	-0.45
17	AVTO-7 x Arka Abha	4.09	1.21	-0.05	29.16	0.63	-0.10
18	AVTO-7 x GT-2	5.03	2.07*	-0.05	28.31	1.18	-0.56
19	AVTO-7 x JT-3	4.49	1.49	0.09	28.10	1.14	-0.57
20	AVTO-7 x AT-3	4.14	1.38	-0.05	28.34	2.09*	-1.35
21	NTL-50 x Arka Abha	3.96	1.03	-0.05	27.38	1.73	-1.29
22	NTL-50 x GT-2	4.24	1.57*	-0.05	28.31	2.82*	-1.34
23	NTL-50 x JT-3	4.82	0.78	-0.05	27.74	2.06*	-1.36
24	NTL-50 x AT-3	4.02	1.26	-0.04	28.25	0.23	-0.04
25	AVTO-4 x Arka Abha	4.12	0.84*	-0.05	29.18	1.28	-0.08
26	AVTO-4 x GT-2	4.27	0.83	0.02	30.96	0.53*	-1.36
27	AVTO-4 x JT-3	4.45	1.36	-0.04	30.97	-0.21	-0.90
28	AVTO-4 x AT-3	4.30	1.21	-0.05	28.25	0.61	-0.33
29	AVTO-5 x Arka Abha	4.25	0.83	-0.05	29.28	0.69	-1.34
30	AVTO-5 x GT-2	5.31	2.17	0.16 *	33.15	0.56	-1.06
31	AVTO-5 x JT-3	4.98	1.44	0.05	32.13	0.21	-0.74
32	AVTO-5 x AT-3	4.26	1.28	-0.04	29.53	1.58	-1.31
33	JTL-08-16 x Arka Abha	4.01	0.41	-0.04	32.74	0.84*	-1.36
34	JTL-08-16 x GT-2	3.94	1.16	0.05	32.58	0.30	-1.34
35	JTL-08-16 x JT-3	4.01	0.61	-0.05	29.49	1.56	0.41
36	JTL-08-16 x AT-3	3.79	1.33	-0.01	30.47	2.27	1.85
37	JTL-08-15 x Arka Abha	3.98	0.96	-0.04	31.51	0.74	-0.90
38	JTL-08-15 x GT-2	4.92	1.72	-0.04	31.35	0.23	2.05
39	JTL-08-15 x JT-3	4.35	0.77	0.29*	29.08	1.51	-1.11
40	JTL-08-15 x AT-3	4.06	1.19	-0.04	30.01	0.55	-1.35
41	JTL-12-12 x Arka Abha	3.92	0.20	-0.01	28.76	1.33	-1.07
42	JTL-12-12 x GT-2	5.04	1.15	0.08	28.73	1.04	-1.06
43	JTL-12-12x JT-3	4.10	0.64	-0.01	28.42	0.90	-1.36
44	JTL-12-12 x AT-3	3.77	0.99	0.01	30.90	0.95	-1.18
45	Abhinav (check)	4.41	1.25	-0.05	30.06	1.12	-1.36
	Hybrid mean	4.37			29.89		

*, ** Significant at 5 per cent and 1 per cent of probability levels, respectively.

Table 4: Stability parameters for lycopene content (mg/100 g) and reducing sugar (%) for parents and hybrids

Sr. No.	Genotype	Lycopene content (mg/100 g)			Reducing sugar (%)		
		Mean	b_i	S^2d_i	Mean	b_i	S^2d_i
1	AVTO-6	3.01	2.09*	-0.11	3.12	0.77	0.02
2	AVTO-7	3.00	1.47	0.21	3.18	1.29	0.14
3	NTL-50	3.28	1.20	0.28	3.11	1.32	-0.09
4	AVTO-4	3.50	0.88	-0.08	3.17	1.38	-0.06
5	AVTO-5	3.64	1.24	-0.06	3.47	1.04	0.11
6	JTL-08-16	3.26	1.95	0.00	2.94	1.26	-0.01
7	JTL-08-15	2.90	0.89	0.25	3.06	1.74	-0.02
8	JTL-12-12	3.55	0.68	-0.01	3.18	1.39	-0.08
9	Arka Abha	2.01	0.04	-0.09	2.14	0.56*	-0.09
10	GT-2	2.62	-0.41	0.03	3.06	1.35	-0.02
11	JT-3	2.79	0.11	-0.10	2.62	0.77	-0.09
12	AT-3	2.82	1.18	-0.11	2.75	0.35	-0.03
	Parental mean	3.03			2.98		
13	AVTO-6 x Arka Abha	3.68	0.93	0.02	3.30	1.26	-0.06
14	AVTO-6 x GT-2	4.06	0.85	-0.06	3.06	0.76	-0.08
15	AVTO-6 x JT-3	3.80	0.25*	-0.11	3.04	0.90	-0.08
16	AVTO-6 x AT-3	3.73	0.07	-0.10	3.18	1.40	-0.08
17	AVTO-7 x Arka Abha	3.94	1.72	-0.08	4.14	1.37	-0.09
18	AVTO-7 x GT-2	4.70	0.62	0.05	3.29	1.01	-0.09
19	AVTO-7 x JT-3	4.82	0.75	-0.09	2.67	0.43*	-0.09
20	AVTO-7 x AT-3	4.04	1.38	-0.09	2.70	1.23	0.23
21	NTL-50 x Arka Abha	3.95	1.64*	-0.11	2.82	0.98	0.07
22	NTL-50 x GT-2	4.50	1.73	-0.10	2.88	0.05	-0.01
23	NTL-50 x JT-3	3.84	1.57	-0.10	3.17	0.93	-0.09
24	NTL-50 x AT-3	4.88	1.04	0.00	2.78	1.14	-0.08
25	AVTO-4 x Arka Abha	4.19	0.70	-0.10	2.73	0.56	0.00
26	AVTO-4 x GT-2	4.08	2.92	0.38 *	2.53	0.64	0.20
27	AVTO-4 x JT-3	4.93	0.79	-0.11	4.03	1.36	0.01
28	AVTO-4 x AT-3	4.01	0.67	-0.08	3.61	0.74	0.05
29	AVTO-5 x Arka Abha	4.11	1.23	-0.07	3.19	0.87	-0.09
30	AVTO-5 x GT-2	5.25	0.25*	-0.11	4.21	1.67	-0.09
31	AVTO-5 x JT-3	4.09	1.18	-0.09	2.98	1.00	-0.06
32	AVTO-5 x AT-3	4.91	1.90*	-0.11	2.98	0.57	-0.03
33	JTL-08-16 x Arka Abha	3.95	-0.12	0.03	3.03	0.59	0.02
34	JTL-08-16 x GT-2	3.73	1.90	0.16	3.02	0.80	0.04
35	JTL-08-16 x JT-3	4.10	2.76	0.10	2.56	0.30	-0.08
36	JTL-08-16 x AT-3	3.86	0.57	-0.11	2.77	0.10*	-0.09
37	JTL-08-15 x Arka Abha	3.97	0.94	-0.11	2.76	0.79	0.02
38	JTL-08-15 x GT-2	4.91	0.20	-0.11	4.21	1.44*	-0.09
39	JTL-08-15 x JT-3	4.72	0.91	-0.10	3.02	0.98	-0.04
40	JTL-08-15 x AT-3	4.12	1.19	-0.08	2.71	0.94	-0.08
41	JTL-12-12 x Arka Abha	4.03	1.05	-0.09	3.37	1.23	-0.06
42	JTL-12-12 x GT-2	5.08	0.33	-0.06	4.19	1.53	-0.07
43	JTL-12-12x JT-3	4.92	-0.02	-0.05	4.15	1.45	-0.09
44	JTL-12-12 x AT-3	4.07	1.13	-0.03	3.23	1.47	-0.06
45	Abhinav (check)	4.31	0.69	-0.11	3.53	1.32	-0.08
	Hybrid mean	4.28			3.19		

*, ** Significant at 5 per cent and 1 per cent of probability levels, respectively.

For lycopene content, among the parents, NTL-50 and AVTO-5 showed high mean values, low S^2d_i values with greater than one b_i values. A parent AVTO-4 was registered high mean values with low S^2d_i values and b_i values less than unity. Among the different crosses, two crosses NTL-50 x AT-3 and JTL-08-15 x JT-3 were registered high mean values, low S^2d_i value with b_i values nearer to unity. The cross combination AVTO-4 x JT-3 was registered higher mean values, low deviation from regression values and less than one regression coefficients. A cross combination AVTO-5 x GT-2 was exhibited above average stability. Hence, they are suitable for poor environment.

For reducing sugar (per cent), among the parents, AVTO-5 was registered high mean value, low S^2d_i value with b_i values nearer to unity while, AVTO-7, NTL-50, AVTO-4, JTL-08-15 and GT-2 showed high mean values, low S^2d_i values with greater than one b_i values. Among the different crosses, AVTO-7 x GT-2 was registered high mean values, low S^2d_i value with b_i values nearer to unity. Hybrid combinations *viz.,* AVTO-6 x Arka Abha, AVTO-7 x Arka Abha, AVTO-5 x GT-2, JTL-12-12 x Arka Abha, JTL-12-12 x GT-2 and JTL-12-12 x JT-3 were registered high mean values, greater than one regression coefficient and low S^2d_i value. A cross combination JTL-08-15 x GT-2 exhibited higher mean value, low S^2d_i value with significant b_i value, indicated that this genotype perform better in favourable conditions.

From the findings and discussion made so far it may be said that any generalization regarding stability of genotypes for all characters is too difficult. The genotypes studied did not exhibited uniform stability and response pattern for all the characters. Similar results have been reported by Dhaduk *et al*. (2004) and Prasanna *et al*. (2007) [8]. However, out of forty

five genotypes, parent GT-2 and cross AVTO-6 x GT-2 was identified to be stable for wider environments and could be utilized further for yield improvement in tomato.

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