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Stability for quality and physiological traits of tomato under high temperature conditions over dates of sowing

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Abstract
An investigation was carried out with twenty five genotypes to study phenotypic stability based on Eberhart and Russel model over three dates of sowing *viz.*, February, March and April sowings in Vegetable Research Station, Rajendranagar, Hyderabad, Telangana state. Mean sum of squares due to environments was significant for all the traits which indicated the strong influence of environment on genotypes. The genotypes were significantly differed for lycopene content which showed the wide variability for these traits over seasons. Significant mean sum of squares due to genotype x environment interactions were noticed for ascorbic acid and remained non-significant for rest of the traits. Among eight traits studied, Arka Alok andAVTO-9803 for ascorbic acid and PKM-1 for lycopene are recommended for general cultivation. The results revealed that one genotype for number of locules per fruit, Seven genotypes for total soluble solids (TSS), ten genotypes for lycopene, one genotype for stomatal diffusive resistance (SDR), eight genotypes each for relative water content (RWC) and chlorophyll content (CC) are recommended for unfavourable environments and one genotype for number of locules, eleven genotypes for TSS, seven genotypes for lycopene, two genotypes for SDR, five genotypes for RWC and ten genotypes for CC are recommended for favourable environments. Based on favorability of environments, February sowing is best for SDR, RWC and CC characters, March sowing is best for ascorbic acid and lycopene characters and April sowing is best for number of locules per fruit and TSS.

Keywords: physiological traits of tomato, phenotypic stability, environment

Introduction

Tomato (*Solanum lycopersicum* L.) 2n=2x=24 is one of the most important vegetable crop grown widely all over the world. It is a member of Solanaceae family and is native to Central and South America. In the world, it ranks second in importance after potato but tops the list of processed vegetables. It is a very good source of income for small and marginal farmers and also contributes to the nutrition of the consumer (Singh *et al.*, 2010) [10]. The ripe fruits are taken as raw or made into salads, soups, preserve, pickles, ketchup, puree, paste and many other products (Chadha, 2001) [11].

Phenotypic stability is one of the most desirable properties of a genotype to be released as a variety for wider adaptations. The performance of a variety is the result of its genetic constitution and the environment in which it has been grown. In practice, it is quite possible that a particular variety may not exhibit the same phenotypic performance under different environments or different varieties may respond differently to a specific environment. The variation arising between the genetic and non-genetic effects is the genotype–environment interaction. Genotype x Environment interactions is of major importance to the plant breeder in developing improved varieties. When varieties are compared over a series of environments, the relative rankings usually differ. This results in difficulty in detecting superior genotypes. It is therefore, imperative for plant breeders to recognize phenotypically stable genotypes showing less G x E interaction over a broad spectrum of prevailing environments.

Several methods have been reported for analyzing G x E interaction and stability of performance in crop plants (Finlay and Wilkinson, 1963; Eberhart and Russell, 1966; Perkins and Jinks, 1968; Lin *et al*., 1986; Westcott, 1986; Becker and Leon, 1988) [1, 2, 3, 4, 5, 6]. Of various approaches, Eberhart and Russell (1966) [2] and Perkins and Jinks (1968) [3] models have been commonly used to estimate stability parameters in various crop plants. In vegetable crops, however, such studies are less attempted (Kalloo *et al*., 1977; Singh *et al*., 1984) [8, 7]. Therefore, for evolving better and stable varieties for quality components, it is necessary to screen the available genotypes over a wide range of agro climatic conditions for commercial exploitation or effective utilization in breeding programme. According to this model, a desirable and stable genotype is the one having high mean regression coefficient unity (bi=1) and minimum deviation from regression line (S^2d=0). Depending upon particular character, however, the desirable mean could be towards high level or low level. In view of the above, an attempt was made to study the stability parameters of tomato hybrids in three different dates of sowing at one month intervals.

Materials and Methods

The present investigation was performed with twenty five genotypes including 8 parents, 15 hybrids and 2 checks, which were evaluated in RBD with three replications over three dates of sowing *viz*., February, March and April sowings during *Summer*, 2015 at Vegetable Research Station, Rajendranagar, Hyderabad, Telangana state. The data were generated for seven quality and physiological characters *viz*., number of locules per fruit, ascorbic acid content (mg/100g), total soluble solids (°Brix), lycopene content (mg/100g), stomatal diffusive resistance (sec/cm), relative water content (%) and chlorophyll content.

Results and Discussion

The ANOVA revealed significant differences among genotypes of tomato. Mean sum of squares due to environments was significant for all the traits which indicated the strong influence of environment on genotypes. The genotypes were significantly differed for lycopene content which showed the wide variability for these traits over seasons. Significant mean sum of squares due to genotype x environment interactions were noticed for ascorbic acid and remained non-significant for rest of the traits.

Partitioning of mean squares due to environments + (genotypes x environments) were significant for all the characters emphasizing the existence of G x E interactions for all the traits. Sum of squares due to E + (G x E) was further partitioned into that of environment (linear), genotype x environment (linear) and pooled deviation. Significant variation due to environment (linear) and genotype x environment (linear) was observed for all the traits except ascorbic acid indicated the linear contribution of environmental effects and additive environment variance on these characters and the genotypes significantly differing for their linear response to environments, respectively. The mean sum of squares for pooled deviation was non-significant for the traits ascorbic acid, lycopene, stomatal diffusive resistance, relative water content and chlorophyll content indicating the non-linear response and unpredictable nature of genotypes by significantly differing for stability.

Paroda and Hayes (1971) suggested that the regression coefficient could be regarded as a varietal response to environmental fluctuation, while the deviation around the regression line could be most suitable measure of its stability. Thus, genotypes with non-significant deviation from regression were considered stable and vice versa. Accordingly, the mean performance along with the regression coefficient and the deviation from linearity of each genotype represented its adaptability

Evaluation of the genotypes for stability parameters for the character number of locules per fruit revealed that the performance of eleven hybrids, five parents and two checks could be predicted, whereas the remaining exhibited significant and minimum deviation from the regression line (S^2di) could be unpredicted as their performance differed with the varied environments. The trait ranged from 2.91 (AVTO-1007) to 4.38 (Arka Vikas) with a general mean of 3.66 (Table 1). None of the genotypes recorded higher mean values for the trait compared to the superior check Lakshmi (4.04) but the genotype PKM-1 recorded regression coefficient more than unity (bi>1) indicating below average stability which can be adapted for favourable environment while, the genotype Arka Vikas recorded regression coefficient less than unity (bi<1) indicating above average stability which can be adapted for unfavourable or poor environments.

The mean values for ascorbic acid content among the genotypes varied from 15.77 mg/100 g (Arka Alok x AVTO-9001) to 21.53 mg/100 g (AVTO-1002) with an overall mean of 18.64 mg/100 g (Table 1) in which, only one genotype Arka Vikas x AVTO-1007 was recorded significant and minimum deviation from the regression line (S^2di) designate the impact of environment (G x E interaction) over the cross, where its performance cannot be predicted. None of the genotypes reported significant for the trait ascorbic acid compared to the superior check US-618 (22.17 mg/100 g). However, the genotypes Arka Alok and AVTO-9803 recorded statistically minimum values for ascorbic acid when compared to the best check US-618 with regression coefficient of unity (bi=1). Therefore these genotypes possess absolute average stability and can be recommended for wider environments as they do not have any impact of environment over their performance.

For total soluble solids (ºBrix), among all the genotypes three parents and one hybrid recorded significant and least deviation from regression line (S^2di) while the remaining five parents and fourteen hybrids recorded non-significant minimum deviation from the regression line hence, the performance of the later genotypes can be predicted over diverse environment. All the genotypes except Arka Vikas x AVTO-0101 recorded statistically higher values for total soluble solids compared to the superior check Lakshmi (5.18 ºBrix). However, the trait ranged from 4.33 ºBrix (AVTO-1002) to 6.24 ºBrix (PKM-1 x AVTO-9001) with an overall genotypes average of 5.53 ºBrix (Table 2). The genotypes Arka Alok, Arka Alok x AVTO-1007, Arka Alok x AVTO-9001, Arka Alok x AVTO-9803, Arka Alok x AVTO-1002, PKM-1 x AVTO-1007, PKM-1 x AVTO-9803, PKM-1 x AVTO-0101, Arka Vikas x AVTO-9803, Arka Vikas x AVTO-9001 and Arka Vikas x AVTO-1002 recorded regression coefficient more than unity (bi>1) indicating below average stability and are recommended to favourable environment whereas, the genotypes Arka Vikas, AVTO-9803, AVTO-9001, AVTO-1002, Arka Alok x AVTO-0101, PKM-1 x AVTO-9001 and PKM-1 x AVTO-1007 recorded regression coefficient less than unity (bi<1) indicating above average stability and are recommended for unfavourable or poor environments.

For lycopene content five parents and thirteen hybrids recorded non-significant and minimum deviation from regression line (S^2di) among all genotypes under the study whose performance can be predicted over diversed environments. The parents PKM-1and AVTO-1007 and all the crosses except Arka Vikas x AVTO-1007 and Arka Vikas x AVTO-9001 recorded maximum lycopene content than the best check Lakshmi 4.66 mg/100 g, where the trait ranged from4.17 mg/100 g (AVTO-1002) to 7.59 mg/100 g (Arka Vikas x AVTO-9803) with an overall mean of 6.03 mg/100 g (Table 2). The genotype PKM-1 recorded significantly higher lycopene content compared to the best check Lakshmi with regression coefficient absolute unity (bi=1). Hence, it was considered to possess the average stability whose performance does not changed with the change in environments and the genotype may be recommended for wider environments. Among the stable genotypes Arka Alok, AVTO-9001, AVTO-1002, Arka Alok x AVTO-1007, Arka Alok x AVTO-0101, PKM-1 x AVTO-1007, PKM-1 x AVTO-9001, PKM-1 x AVTO-0101, Arka Vikas x AVTO-9803 and Arka Vikas x AVTO-0101 registered regression coefficient more than unity (bi<1) indicating above average stability and can be adapted over unfavourable or poor environments while, the genotypes AVTO-1007,Arka Alok x AVTO-9803, Arka Alok x AVTO-9001, Arka Alok x AVTO-1002, PKM-1 x AVTO-9803, PKM-1 x AVTO-1002 and Arka Vikas x AVTO-1002 recorded regression coefficient more than unity (bi>1) indicating below average stability and are adapted to favourable environments.

The mean values for stomatal diffusive resistance among the genotypes varied from 3.19sec/cm (AVTO-9001) to 7.32sec/cm (AVTO-0101) with a general mean of 4.68sec/cm (Table 3).All the genotypes under the study recorded to be non-significant and minimum deviation from the regression line (S^2di) thus predicting their performance over diversified environments. Among the stable genotypes AVTO-9803 and Arka Alok x AVTO-0101 registered higher values for the trait compared to the superior check US-618 and regression coefficient more than unity (bi>1) revealing below average stability and can be adapted in favourable environments while, the genotype Arka Vikas x AVTO-9803 recorded regression coefficient less than unity (bi<1) revealing above average stability and can be adapted in unfavourable or poor environments.

The average values for relative water content among the genotypes varied from 32.30 per cent (AVTO-1007) to 50.79 per cent (Arka Alok x AVTO-1002) with an overall mean of 44.13 per cent. The hybrids Arka Alok x AVTO-9803, PKM-1 x AVTO-1002 and Arka Vikas x AVTO-1007 recorded significant and minimum deviation from the regression line depicting the preponderance of unpredictable G x E interaction (Table 3). The genotypes AVTO-1007, AVTO-1002, Arka Alok x AVTO-9001, Arka Alok x AVTO-0101, PKM-1 x AVTO-9001, PKM-1 x AVTO-9803, Arka Vikas x AVTO-9803 and Arka Vikas x AVTO-9001 recorded regression coefficient less than unity (bi<1) thus, revealing above average stability and the genotypes can be recommended for unfavourable or poor environments whereas, the genotypes Arka Alok, AVTO-0101, Arka Alok x AVTO-1002, PKM-1 AVTO-1007, Arka Vikas x AVTO-0101 and Arka Vikas x AVTO-1002 recorded regression coefficient more than unity (bi>1) thus, revealing below average stability and these genotypes can be recommended to favourable environments.

The mean values for chlorophyll content among the genotypes recorded maximum in AVTO-9803 (1.86%) and minimum in Arka Vikas (0.68%) with an overall mean of 1.26 per cent (Table 4). The genotypes Arka Alok x AVTO-9803, PKM-1 x AVTO-9001 and Arka Vikas x AVTO-1002 recorded significant and minimum deviation from the regression line indicating the preponderance of unpredictable G x E interaction. Among the stable genotypes PKM-1, AVTO-1007, AVTO-9803, AVTO-9001, AVTO-0101, Arka Alok x AVTO-9001, Arka Alok x AVTO-1002, PKM-1 x AVTO-9803, PKM-1 x AVTO-0101 and Arka Vikas x AVTO-1007 registered statistically significant values compared to superior check Lakshmi and regression coefficient more than unity (bi>1) indicating below average stability which can be adapted to favourable environments whereas, the genotypes AVTO-1007, AVTO-1002, Arka Alok x AVTO-0101, PKM-1 x AVTO-1007, PKM-1 x AVTO-1002, Arka Vikas x AVTO-9803, Arka Vikas x AVTO-9001 and Arka Vikas x AVTO-0101 recorded regression coefficient less than unity (bi<1) indicating above average stability which can be adapted to unfavourable environments.

Table 1: Stability parameters for number of locules per plant and ascorbic acid in tomato

Genotype/cross	**No. of locules per plant**			**Ascorbic acid (mg/100 g)**		
	μ	**βi**	**S²di**	**μ**	**βi**	**S²di**
Arka Alok	3.53	1.24**	-0.02	19.01	1.00	-1.78
PKM 1	4.29	1.38	-0.02	15.81	0.88	-1.93
Arka Vikas	4.38	0.65	-0.02	17.75	0.95	-1.92
AVTO 1007	2.91	1.09	-0.02	19.74	1.08	-1.78
AVTO 9803	3.64	1.09	-0.02	18.01	1.00	-1.93
AVTO 9001	3.33	1.24**	-0.02	16.82	0.92	-1.88
AVTO 0101	3.53	1.24**	-0.02	18.67	1.06*	-1.94
AVTO 1002	3.56	0.94	-0.02	21.53	1.22	-1.90
A.Alok X AVTO 1007	3.56	0.41	0.04	17.91	1.82	-0.46
A.Alok X AVTO 9803	3.67	1.95	0.02	16.31	0.02	-0.72
A.Alok X AVTO 9001	3.78	0.91	-0.01	15.77	1.37	0.27
A.Alok X AVTO 0101	3.33	0.27*	-0.02	19.86	0.01	-1.35
A.Alok X AVTO 1002	3.47	0.26	0.03	19.26	1.18	2.55
PKM-1 X AVTO 1007	3.76	1.56	0.00	18.17	1.25	0.69
PKM-1 X AVTO 9803	3.80	0.62	-0.01	17.21	1.74	1.92
PKM-1 X AVTO 9001	3.67	1.85	-0.01	19.24	0.91	-1.50
PKM-1 X AVTO 0101	3.27	1.50	0.05	21.16	0.95	-1.90
PKM-1 X AVTO 1002	3.58	-0.85	0.07*	19.81	1.34	3.08
A. Vikas X AVTO 1007	3.62	1.65**	-0.02	18.41	0.10	5.81*
A. Vikas X AVTO 9803	3.93	0.88	-0.01	16.29	0.27	0.34
A.Vikas X AVTO 9001	3.58	0.21	-0.01	17.37	0.06	1.01
A. Vikas X AVTO 0101	3.67	1.50	0.51**	19.79	1.87	1.50
A.Vikas X AVTO 1002	3.91	1.27	-0.02	18.59	1.70	-0.96
Lakshmi	4.04	1.53	0.26	21.44	1.43	-1.17
US 618	3.80	0.62	0.37	22.17	0.89	-0.22
Mean	3.66			18.64		
SE of bi	0.18	0.73		0.92	0.56	
CD (5%)	0.15			0.76		

Table 2: Stability parameters for total soluble solids and lycopene in tomato

Genotype/cross	Total soluble solids (°Brix)			Lycopene content (mg/100g)		
	µ	□i	S²di	µ	□i	S²di
Arka Alok	4.96	1.74	-0.03	5.12	0.86	-0.22
PKM 1	5.20	0.16**	-0.06	5.60	1.00	-0.22
Arka Vikas	4.77	0.84	-0.01	7.44	1.29*	-0.22
AVTO 1007	4.73	-0.32*	-0.06	5.57	1.03	-0.22
AVTO 9803	4.88	0.32	-0.06	6.92	1.22*	-0.22
AVTO 9001	4.79	0.54	-0.05	4.67	0.85	-0.22
AVTO 0101	4.64	1.46	0.41**	4.61	0.84**	-0.22
AVTO 1002	4.33	0.58	0.10	4.16	0.58	-0.20
A.Alok X AVTO 1007	5.93	1.59	-0.05	6.64	0.74	-0.09
A.Alok X AVTO 9803	5.72	1.17	-0.02	6.72	1.19	0.13
A. Alok X AVTO 9001	6.17	1.67	-0.01	5.79	1.59	-0.02
A.Alok X AVTO 0101	5.84	-0.18	0.01	5.69	0.76	-0.13
A.Alok X AVTO 1002	6.13	2.38	-0.01	5.86	1.02	-0.16
PKM-1 X AVTO 1007	6.00	1.55	0.02	5.99	0.93	0.04
PKM-1 X AVTO 9803	6.10	1.63	-0.06	7.42	1.87	0.13
PKM-1 X AVTO 9001	6.24	0.40	0.07	6.80	0.88	-0.19
PKM-1 X AVTO 0101	6.04	1.55	0.03	5.89	0.37	-0.03
PKM-1 X AVTO 1002	6.06	0.79	-0.05	6.96	1.79	-0.21
A.Vikas X AVTO 1007	6.09	0.06	0.01	6.70	1.34	0.78*
A.Vikas X AVTO 9803	5.93	1.45	-0.06	7.59	0.43	0.12
A Vikas X AVTO 9001	5.67	1.21	0.07	6.31	0.53	0.77*
A.Vikas X AVTO 0101	6.11	1.88	0.30*	6.80	0.80	0.14
A.Vikas X AVTO 1002	5.81	1.50	-0.02	6.45	1.59	-0.22
Lakshmi	5.18	-0.06	-0.05	4.66	0.40	0.04
US 618	5.01	1.10	0.74	4.50	1.14	-0.22
Mean	5.53			6.03		
SE of bi	0.23	1.11		0.31	0.32	
CD (5%)	0.19			0.25		

Table 3: Stability parameters for stomatal diffusive resistance and relative water content in tomato

Genotype/cross	Stomatal diffusive resistance (sec/cm)			Relative water content (%)		
	M	□i	S²di	µ	□i	S²di
Arka Alok	4.70	0.74	-0.58	42.28	1.03	-7.52
PKM 1	3.36	0.34	-0.52	36.99	0.96	-7.72
Arka Vikas	3.49	0.08	-0.42	33.70	0.84	-7.73
AVTO 1007	4.20	1.07	-0.59	32.30	0.86	-7.19
AVTO 9803	6.06	1.49	-0.60	37.91	0.95	-7.85
AVTO 9001	3.19	0.80	-0.60	35.54	0.94	-7.24
AVTO 0101	7.32	1.85	-0.59	44.22	1.15	-7.75
AVTO 1002	3.74	0.73	-0.59	47.37	0.86	-0.03
A.Alok X AVTO 1007	4.75	2.52	-0.02	44.92	0.40	-4.96
A.Alok X AVTO 9803	4.91	-0.08	0.60	46.49	2.15	6.97
A.Alok X AVTO 9001	4.00	2.64	-0.07	46.47	0.10	-2.30
A.Alok X AVTO 0101	5.52	1.71	-0.31	48.55	0.40	-7.65
A.Alok X AVTO 1002	4.93	0.53	0.45	50.79	1.23	-7.80
PKM-1 X AVTO 1007	5.04	0.05	0.36	50.55	1.11	-7.22
PKM-1 X AVTO 9803	4.90	1.97	-0.37	44.24	0.95	7.80
PKM-1 X AVTO 9001	4.40	0.34	-0.45	46.77	0.47	11.79
PKM-1 X AVTO 0101	5.13	0.73	-0.47	49.77	0.84	14.38
PKM-1 X AVTO 1002	4.89	1.34	0.67	46.06	0.19*	-7.87
A.Vikas X AVTO 1007	4.35	0.96	-0.08	45.89	2.26*	-7.71
A.Vikas X AVTO 9803	5.19	0.94	-0.57	46.69	0.79	-4.71
A.Vikas X AVTO 9001	4.32	-0.89	-0.42	45.26	0.37	-6.02
A.Vikas X AVTO 0101	4.92	2.17	-0.29	47.62	2.15	8.72
A.Vikas X AVTO 1002	4.39	0.69	0.52	47.94	1.89	14.35
Lakshmi	4.59	1.88	-0.50	42.38	0.78	-4.42
US 618	4.79	0.40	-0.34	42.61	1.36	-7.76
Mean	4.68			44.13		
SE of bi	0.43	0.63		1.99	0.55	
CD (5%)	0.35			1.64		

Table 4: Stability parameters for chlorophyll content in tomato

Genotype/cross	Chlorophyll content (%)		
	µ	□i	S²di
Arka Alok	0.76	0.65	-0.03
PKM 1	1.54	1.39	-0.03
Arka Vikas	0.68	0.61	-0.03
AVTO 1007	1.34	1.27	-0.03
AVTO 9803	1.86	1.66	-0.03
AVTO 9001	1.70	1.59	-0.03
AVTO 0101	1.66	1.52	-0.03
AVTO 1002	1.05	0.66	-0.03
Arka Alok X AVTO 1007	1.40	-1.42	0.07
Arka Alok X AVTO 9803	1.40	0.15	0.14*
Arka Alok X AVTO 9001	1.64	1.10	-0.03
Arka Alok X AVTO 0101	0.99	0.02	-0.03
Arka Alok X AVTO 1002	1.30	3.59	-0.03
PKM-1 X AVTO 1007	1.43	-2.09	-0.03
PKM-1 X AVTO 9803	1.35	2.64	-0.02
PKM-1 X AVTO 9001	1.54	3.22	0.20**
PKM-1 X AVTO 0101	1.14	1.63	0.01
PKM-1 X AVTO 1002	1.05	-0.76	-0.02
Arka Vikas X AVTO 1007	1.14	1.24	-0.03
Arka Vikas X AVTO 9803	1.38	-0.71	0.13*
Arka Vikas X AVTO 9001	1.31	-1.31	-0.01
Arka Vikas X AVTO 0101	1.06	0.99	0.02
Arka Vikas X AVTO 1002	1.39	4.09	0.17 *
Lakshmi	0.75	0.83	-0.03
US 618	0.71	0.45	-0.03
Mean	1.26		
SE of bi	0.14	1.40	
CD (5%)	0.12		

Table: Environmental indices for each environment for yield and yield contributing characters in tomato

S. No.	Character	Environmental indices		
		February	March	April
1.	No. of locules per fruit	-0.216	-0.053	0.269
2.	Ascorbic acid (mg/100 g)	-1.860	1.308	0.552
3.	Total soluble solids (°Brix)	-0.198	-0.016	0.214
4.	Lycopene content (mg/100 g)	-0.079	0.995	-0.915
5.	Stomatal diffusive resistance (sec/cm)	-0.106	0.734	-0.628
6.	Relative water content (%)	4.204	-2.142	-2.062
7.	Chlorophyll content (%)	0.119	-0.059	-0.060

Table XX: Average performance of genotypes in each environment and in pooled analysis for yield and yield contributing characters in tomato

S. No.	Character	Environment			
		February	March	April	Pooled
1	Plant height (cm)	90.52	88.60	83.14	87.42
2	Root length (cm)	36.61	31.12	30.54	32.76
3	Root to shoot ratio	0.42	0.36	0.38	0.39
4	No. of primary branches	9.26	8.18	8.06	8.50
5	Days to 50% flowering	41.20	39.99	38.60	39.93
6	No. of flowers per cluster	5.71	5.16	4.97	5.28
7	No. of clusters per plant	29.36	25.55	24.69	26.53
8	Stigma exertion (%)	13.66	16.08	22.83	17.52
9	Fruit set (%)	44.08	33.55	35.46	37.70
10	Days to first fruit harvest	65.05	71.64	76.99	71.23
11	Days to last fruit harvest	138.21	137.60	125.00	133.59
12	No. of fruits per cluster	2.53	1.75	1.78	2.02
13	No. of fruits per plant	38.20	31.04	32.85	34.03
14	Fruit length (cm)	4.76	4.51	4.49	4.59
15	Fruit width (cm)	5.43	5.03	4.80	5.08
16	Average fruit weight (g)	62.87	66.66	56.34	61.96
17	Fruit yield per plant (kg)	2.358	2.03	1.81	2.07
18	No. of seeds per fruit	42.16	44.43	32.76	39.78
19	No. of locules per fruit	3.45	3.61	3.93	3.66
20	Ascorbic acid (mg/100 g)	16.78	19.95	19.20	18.64
21	Total soluble solids (°Brix)	5.34	5.52	5.75	5.53
22	Lycopene content (mg/100 g)	5.96	7.03	5.12	6.03
23	Stomatal diffusive resistance (sec/cm)	4.58	5.42	4.06	4.68
24	Relative water content (%)	48.34	42.00	42.07	44.13
25	Chlorophyll content (%)	1.38	1.20	1.20	1.26

Table: Summary of stability parameters for different environments in tomato genotypes

S. no.	Character	Stable (bi=1)	Poor or rainfed environment (bi<1)	Rich or irrigated environment (bi>1)
1	Number of locules per fruit		Arka Vikas	PKM-1
2	Ascorbic acid	Arka Alok and AVTO-9803		
3	Total soluble solids		Arka Vikas, AVTO-9803, AVTO-9001, AVTO-1002, Arka Alok x AVTO-0101, PKM-1 x AVTO-9001 and PKM-1 x AVTO-1007	Arka Alok, Arka Alok x AVTO-1007, Arka Alok x AVTO-9001, Arka Alok x AVTO-9803, Arka Alok x AVTO-1002, PKM-1 x AVTO-1007, PKM-1 x AVTO-9803, PKM-1 x AVTO-0101, Arka Vikas x AVTO-9803, Arka Vikas x AVTO-9001 and Arka Vikas x AVTO-1002
4	Lycopene content	PKM-1	Arka Alok, AVTO-9001, AVTO-1002, Arka Alok x AVTO-1007, Arka Alok x AVTO-0101, PKM-1 x AVTO-1007, PKM-1 x AVTO-9001, PKM-1 x AVTO-0101, Arka Vikas x AVTO-9803 and Arka Vikas x AVTO-0101	AVTO-1007, Arka Alok x AVTO-9803, Arka Alok x AVTO-9001, Arka Alok x AVTO-1002, PKM-1 x AVTO-9803, PKM-1 x AVTO-1002 and Arka Vikas x AVTO-1002
5	Stomatal diffusive resistance		Arka Vikas x AVTO-9803	AVTO-9803 and Arka Alok x AVTO-0101
6	Relative water content		AVTO-1007, AVTO-1002, Arka Alok x AVTO-9001, Arka Alok x AVTO-0101, PKM-1 x AVTO-9001, PKM-1 x AVTO-9803, Arka Vikas x AVTO-9803 and Arka Vikas x AVTO-9001	Arka Alok, AVTO-0101, Arka Alok x AVTO-1002, PKM-1, AVTO-1007, Arka Vikas x AVTO-0101 and Arka Vikas x AVTO-1002
7	Chlorophyll content		AVTO-1007, AVTO-1002, Arka Alok x AVTO-0101, PKM-1 x AVTO-1007, PKM-1 x AVTO-1002, Arka Vikas x AVTO-9803, Arka Vikas x AVTO-9001 and Arka Vikas x AVTO-0101	PKM-1, AVTO-1007, AVTO-9803, AVTO-9001, AVTO-0101, Arka Alok x AVTO-9001, Arka Alok x AVTO-1002, PKM-1 x AVTO-9803, PKM-1 x AVTO-0101 and Arka Vikas x AVTO-1007

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