International Journal of Chemistry Studies
ISSN: 2581-348X; Impact Factor: RJIF 5.44
Received: 04-02-2019; Accepted: 07-03-2019
www.chemistryjournal.in
Volume 3; Issue 3; May 2019; Page No. 17-26

Stability studies among tomato genotypes for yield and processing traits

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Abstract
Field experiments were takenup to evaluate eleven parents, thirty crosses and three commercial checks of tomato (*Solanum lycopersicum L.*) for stability studies involving yield and processing traits. Results from the investigation revealed significant differences among the genotypes for all the traits evaluated. Pooled analysis of variance indicated significant differences among genotypes and environments and the interaction component, genotype × environment was also significant for the traits studied. The hybrids as a whole exhibited higher mean values with regression coefficients around unity, indicating greater production and stability. The present study emphasized that crosses viz., EC-620360 × Pusa Ruby and EC-608415 × Arka Saurabh, EC-608415 × Arka Abha, EC-608415 × Punjab Chhuhara and EC-619982 × EC-620557 with significant mean and bi<1 possess above average stability and are adapted to unfavourable environments. These hybrids are to be further evaluated under different locations to confirm their stability for commercial hybrid development.

Keywords: G × E interaction, processing, stability, tomato, yield

1. Introduction
Tomato (*Solanum lycopersicum* L., 2n=24) is widely grown vegetable in the world from temperate to tropical climate. It surpasses all vegetables in terms of total contribution of essential nutrients to diet due to its wide consumption and diverse uses (Nwosu *et al*., 2014). In India, tomato is grown in an area of 0.882 million hectares with annual production of 18.74 million tonnes and productivity of 21.2 tonnes/ha (NHB, 2017). It is consumed in fresh form as salad and in processed forms like soup, sauce, ketchup, paste, puree, powder and canned whole fruit etc. and tops the list of processed vegetables [25]. It contains most powerful anti-oxidant compound called "lycopene" which have effective anti-cancer properties [4, 28, 8, 17] and a good source of Vitamins A, B, C [9, 2]. Tomato flushes out free radicals, protect against inflammation, heart diseases and prevent DNA damage in human body. It is also used in preparation of many natural beauty cosmetics [24, 7].
The relative performance of genotypes for quantitative characteristics such as yield and others which influence yield, vary from one environment to another. Consequently, to develop a genotype with high yielding ability and consistency, high attention should be given to the importance of stable performance for the genotypes under different environments and their interactions which had important bearing on breeding for better varieties buffering [3]. 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 [21]. Hence the present investigation was undertaken to study the effect and magnitude of genotype-environment interactions and for identifying and selecting stable genotypes suitable for processing in conjuction with higher yield.

2. Material and Methods
The experiment was conducted during 2014-16 at Vegetable Research Station of Sri Konda Laxman Telangana State Horticultural University, Hyderabad, India, situated at an altitude of 542.6 m above mean sea level. Geographically it lies at latitude of 17.19^0 N and a longitude of 79.23^0 E. The treatments comprise of thirty F1 hybrids of tomato along with eleven parents (five lines and six testers) and three commercial checks viz., US-440, Arka Rakshak and NS-516 layout in Randomized Block Design. Nineteen observations relating to yield and processing traits were recorded. The data obtained were analyzed statistically to test the significance of the treatments [33]. Genotypes × Environment interaction and stability analysis of different genotypes were worked out as per procedure laid out by [11]. According to this model a stable genotype is one with a regression slope near to one, deviation from regression line being close to zero and higher mean yield. The three stability parameters viz., mean, regression coefficient (bi) and mean square deviation from regression line (S^2di) were estimated for all the characters.

3. Results and discussion
The analysis revealed that the genotypes and environments were significant for all the nineteen characters indicating the diversity among the genotypes and environments studied (table 6). The G × E interaction were significant for plant height, number of flowers per cluster, number of fruits per cluster, average fruit weight, fruit yield per plant, ascorbic acid content, total sugars and lycopene content implying differential behaviour of genotypes under three environments whereas for remaining characters G × E interactions was found to be non-significant. Similar type reports were earlier made by [42, 26, 5].
Partitioning sum of squares into that of genotypes,

environments + (genotype × environments) and pooled error revealed that mean squares due to environments + (genotype × environments) were significant for all characters except for days to 50% flowering, pericarp thickness, pH, total soluble solids, titrable acidity and reducing sugars emphasizing the existence of G×E interactions for these traits.

Sum of squares due to E + (G×E) was further partitioned into environments (linear), genotype × environment (linear) and pooled deviation. Significant variation due to environment (linear) was observed for all the characters studied except total soluble solids revealing the linear contribution of environmental effects and additive environment variance on these traits. The linear component of genotype × environment was significant for eight characters viz., plant height, number of flowers per cluster, number of fruits per cluster, average fruit weight, fruit yield per plant, ascorbic acid content, total sugars and lycopene content. The mean sum of squares for pooled deviation was significant for days to 50% flowering, fruit length, fruit width, days to 1st fruit harvest, days to last fruit harvest, pericarp thickness, fruit pH, total soluble solids, titrable acidity and reducing sugars indicating that the deviation from linear regression contributed substantially towards the difference in stability of genotypes. These results are inline with that reported by [42].

Stability parameters

Stability of genotypes for yield is the consequence of stability for its component traits (Grafius, 1956). The results obtained are presented trait wise in the table 1 to 5.

Plant height determines the fruit bearing surface and is considered as one of the important growth attribute governing yield. The genotypes, EC-620407, EC-620428, EC-620360, EC-520078, EC-620557, EC-620407 × Pusa Ruby, EC-620407 × EC-520078, EC-620407 × EC-620557, EC-620428 × Arka Abha, EC-620428 × EC-520078, EC-620428 × EC-620557, EC-620360 × Arka Saurabh, EC-620360 × Arka Abha, EC-620360 × Punjab Chhuhara, EC-620360 × Pusa Ruby, EC-620360 × EC-520078, EC-620360 × EC-620557, EC-608415 × Pusa Ruby, EC-608415 × EC-520078, EC-608415 × EC-620557, EC-619982 × Arka Saurabh, EC-619982 × Arka Abha, EC-619982 × Punjab Chhuhara, EC-619982 × Pusa Ruby, EC-619982 × EC-520078 and EC-619982 × EC-620557 manifested significant plant height with unit regression value (bi=1) are considered as average stability (table 1). Genotypes, EC-620557 and EC-608415 × Arka Abha with more than unity (bi>1) values displayed below average stability. Genotype EC-608415 registered regression coefficient value of less than unity (bi<1) exhibited above average stability. Similar results were reported by [21, 29, 26, 41, 22, 39].

High yield is manifested through enhancement in the vegetative characters like number of primary branches per plant. The genotypes Punjab Chhuhara, EC-620407 × Punjab Chhuhara, EC-620407 × EC-520078, EC-620428 × Punjab Chhuhara, EC-620428 × Pusa Ruby, EC-620360 × Arka Saurabh, EC-620360 × Punjab Chhuhara, EC-620360 × Pusa Ruby, EC-620360 × EC-620557, EC-608415 × Punjab Chhuhara, EC-608415 × Pusa Ruby, EC-608415 × EC-520078, EC-619982 × Punjab Chhuhara, EC-619982 × Pusa Ruby and EC-619982 × EC-520078 disclosed more number of primary branches per plant over Arka Rakshak with unit regression value (bi) and manifested average stability. The crosses EC-620407 × Arka Saurabh and EC-620360 × Punjab Chhuhara recorded more than unity (bi>1) considered to possess below average stability (table 1). The genotype EC-608415 exhibited regression coefficient value less than unity (bi<1) considered to possess above average stability. Similar findings were also reported by [34, 39, 36].

The trait, days to 50% flowering, is an important indicator for earliness of the crosses. Among the stable genotypes, EC-520078 exhibited significantly earlier days to 50% flowering compared to Arka Rakshak with unit regression coefficient (bi) value exhibited average stability (table 1). These results are in accordance with the observations made by [32, 19, 16, 4, 27, 22, 39, 36] for significant nonlinear G × E interactions for days to 50% flowering.

For Number of flowers per cluster trait the genotypes, Punjab Chhuhara, EC-520078, EC-620407 × EC-520078, EC-620428 × Punjab Chhuhara, EC-620428 × EC-520078, EC-620360 × Punjab Chhuhara, EC-620360 × EC-520078, EC-608415 × Punjab Chhuhara, EC-608415 × EC-520078, EC-619982 × Punjab Chhuhara, EC-619982 × Pusa Ruby and EC-619982 × EC-520078 disclosed significantly higher values with unit regression values (bi=1) considered to possess average stability (table 1). The crosses EC-620428 × Punjab Chhuhara, EC-620360 × EC-620557, EC-608415 × Punjab Chhuhara and EC-619982 × Pusa Ruby recorded more than unity (bi>1) regression value displayed below average stability while Arka Abha recorded less than unity (bi<1) and thus possess above average stability. Similar results were reported by [4] in tomato.

Number of fruits per cluster is one of the important characters which directly affect the fruit yield in plants. The genotypes, Punjab Chhuhara, EC-520078, EC-620407 × EC-520078, EC-620428 × EC-520078, EC-620360 × EC-520078, EC-608415 × Punjab Chhuhara, EC-608415 × EC-520078, EC-608415 × EC-620557, EC-619982 × Punjab Chhuhara, EC-619982 × Pusa Ruby, and EC-619982 × EC-520078 recorded significantly more fruits per cluster over Arka Rakshak with unit regression values (bi=1) exhibited average stability (table 2). The cross EC-620428 × EC-620557 recorded more than unity value (bi>1) and possess below average stability. The present findings are in accordance with the those made by [4, 27].

Fruit length and fruit fruit width are growth attributes directly associated with yield. Among the crosses, EC-620360 × EC-620557 manifested significantly lengthy fruits than the best check NS-516 and recorded regression coefficient value equal to one. Hence, they are considered to be stable and can be recommended for wider environments whereas Pusa Ruby, EC-608415 × Arka Saurabh and US-440 exhibited regression coefficient value of less than one recommended for unfavourable environments (table 2). The crosses EC-620407 × EC-620557, EC-620428 × Pusa Ruby, EC-620360 × Arka Abha, EC-620360 × Pusa Ruby, EC-608415 × Arka Abha and EC-619982 × Arka Abha exhibited significantly higher fruit width over Arka Rakshak (5.23 cm) with unit regression value (bi). Only one cross, EC-620407 × Arka Abha was found to be adapted to favourable environments because of below average stability with regression coefficient significantly more than unity (bi>1) (table 2). Results are inline with that of [41, 22, 36].

EC-620428, EC-620407 × Pusa Ruby, EC-620428 × Arka Saurabh, EC-620360 × Arka Abha, EC-620360 × Punjab Chhuhara, EC-620360 × EC-620557, EC-608415 × Arka Abha and EC-619982 × Pusa Ruby with significant average

fruit weight than NS-516 (77.44 g) recorded unit regression coefficient (bi=1) and displayed average stability. Genotypes EC-520078, EC-620407 × EC-520078, EC-620428 × EC-520078, EC-620360 × EC-520078, EC-608415 × EC-520078 and EC-619982 × EC-520078 recorded less than unit value of regression (bi) exhibited above average stability, while the cross, EC-620360 × Pusa Ruby with regression value of more than one is considered to be below average stability (table 2). The results coincide with that of [38, 41, 27, 22, 36].

Days to first fruit harvest is a measure of earliness, as early harvesting gives better returns and also widens the fruiting period of the genotypes. Among the stable hybrids, three crosses viz., EC-620407 × Punjab Chhuhara, EC-608415 × EC-520078 and EC-619982 × Arka Abha with significantly lesser mean value for days to first fruit harvest compared to Arka Rakshak recorded less than one value for regression coefficient (bi) and displayed above average stability (table 3). Similar results were reported by Cuartero and Cubero, (1982), Alok and Singh, (2009), Ummyiah *et al*, (2015), Krishna *et al*, (2017) and Shankar *et al*, (2017) for days to first fruit harvest.

Among the stable genotypes, EC-620428 × EC-620557 (144.44) performed superior to Arka Rakshak (141.00) and recorded unit regression coefficient values for days to last fruit harvest (bi=1) (table 3). Similar results were reported by [19, 4, 22, 39] (Table 3).

Crosses EC-608415 × Arka Abha, EC-608415 × Punjab Chhuhara and EC-619982 × EC-620557 and EC-608415 × EC-620557 with significant mean values for fruit yield per plant manifested above average stability with regression value of less than unity (table 3). Varied response of tomato genotypes to different environments in case of yield per plant was also observed by [34, 6, 21, 20, 12, 41, 27, 22, 37, 39, 36].

Pericarp thickness is an important feature of the tomato fruit, as genotypes with thicker pericarp are better to withstand long distance transportation and remain firm for a longer period, when compared to thinly fleshed tomatoes (Kumari and Sharma, 2011). Among the genotypes evaluated, EC-520078 and EC-620428 × Pusa Ruby recorded less mean values than NS-516 with regression coefficient of less than unity. EC-619982 × EC-520078 and EC-619982 × Pusa Ruby recorded unit regression values (bi=1) while the cross EC-620360 × EC-620557 manifested more than unity regression value. The results reported by [22, 37, 40, 36,] are of similar kind.

For the character fruit pH genotypes, EC-620407, EC-620360, EC-619982, Punjab Chhuhara, Pusa Ruby, EC-620407 × Arka Saurabh, EC-620407 × Arka Abha, EC-620407 × Pusa Ruby, EC-620428 × Punjab Chhuhara, EC-620360 × Pusa Ruby and EC-619982 × Pusa Ruby were with significantly less fruit pH and superior to NS-516 (4.54%) which manifested unit regression value (table 4). Among the stable genotypes, EC-620428 exhibited significantly less fruit pH than NS-516 with regression value of more than unit value revealed above average stability. The results are in line with [40].

Total soluble solids content of tomato fruits is essential for processing purpose. 50% to 65% of soluble solids contents are sugars, glucose and fructose and their amount and proportion influences the organoleptic quality of tomatoes (Adedeji *et al*., 2006). Among the stable genotypes, crosses EC-620407 × EC-520078, EC-620428 × EC-520078, EC-620360 × Pusa Ruby, EC-620360 × EC-520078 and EC-608415 × EC-520078 with significantly more total soluble solids than Arka Rakshak (5.07 ^{0}Brix) recorded unit regression coefficient values revealed average stability (table 4). The cross EC-619982 × EC-520078 recorded significantly more total soluble solids and above average stability with less than one regression value. Similar type of results were reported by [29, 37, 40, 36].

For titrable acidity character the genotypes were on par with the best check US-440 (0.42%) which exhibited unit regression value (table 4). Among the stable genotypes, EC-620428 (0.37%) exhibited significantly on par titrable acidity content with the check US-440 with less than one regression values (bi) manifested above average stability. The present results are inline with [37, 36] in tomato.

Among the stable genotypes, viz., Arka Abha, Punjab Chhuhara, Pusa Ruby, EC- 520078, EC-620428 × Punjab Chhuhara, EC-620428 × Pusa Ruby, EC-620360 × Arka Saurabh, EC-620360 × Arka Abha, EC-620360 × Punjab Chhuhara, EC-620360 × Pusa Ruby, EC-620360 × EC-520078 and EC-619982 × Punjab Chhuhara manifested significant ascorbic acid content than Arka Rakshak (23.86 mg/100g) (table 4). EC-520078 and EC-619982 × EC-620557 with less mean value and b_i value of more than one considered to be below average stability whereas EC-620407 × Arka Saurabh, EC-620407 × Arka Abha, EC-620407 × Punjab Chhuhara, EC-620407 × EC-620557, EC-620428 × Arka Saurabh, EC-620428 × Arka Abha, EC-620428 × EC-520078, EC-620428 × EC-620557, EC-620360 × EC-520078, EC-620360 × EC-620557, EC-608415 × Arka Saurabh, EC-608415 × Arka Abha, EC-608415 × Punjab Chhuhara, EC-608415 × Pusa Ruby, EC-608415 × EC-520078, EC-608415 × EC-620557, EC-619982 × Arka Saurabh, EC-619982 × Pusa Ruby and EC-619982 × EC-520078 with less than unit regression are considered to be above average stability. Similar type of results were reportd by [40, 36].

For the trait total sugars, among the stable genotypes evaluated EC-620557 and cross EC-620407 × EC-620557 with significantly more total sugars values over check US-440 recorded unit regression coefficient values (bi=1). The crosses, EC-620360 × Arka Abha and EC-620360 × Punjab Chhuhara recorded more than one bi value with below average stability whereas EC-619982, Arka Saurabh and EC-608415 × EC-620557 with less than unity bi value disclosed below average stability (table 5).

With respect to reducing sugars genotypes, EC-620407 × EC-620557, EC-620428 × EC-620557, EC-620360 × EC-620557, EC-608415 × EC-620557, EC-619982 × Arka Saurabh and EC-619982 × EC-620557 with significantly more reducing sugars compared to US-440 (3.20) recorded unit regression coefficient values (bi=1) (table 5).

The antioxidant present in fruit i.e. lycopene is essential for colour of fruits. The higher lycopene content genotypes are preferred in market. The genotypes with the highest contents of lycopene and highest antioxidant activity represents a valuable genotype not only for improving the status of dietary antioxidants but also for increasing nutritional value through germplasm enhancement programmes (George *et al*., 2004). Among the stable genotypes, EC-520078, EC-620407 × EC-520078, EC-619982 × EC-520078 and EC-

619982 × EC-620557 exhibited significantly higher lycopene content over Arka Rakshak and displayed stable performance. The crosses EC-620407 × Pusa Ruby, EC-620428 × EC-620557 and EC-620360 × Arka Abha manifested less than unit value of regression coefficient (bi <1) value (table 5). Similar kind of results are reported by [40, 36].

Table 1: Stability parameters for plant height, number of primary branches per plant, days to 50% flowering and number of flowers per cluster.

Genotypes/Crosses	Plant height (cm)			No. of primary branches per plant			Days to 50% flowering			Number of flowers per cluster		
	μ Mean	bi	S^2di	μ Mean	bi	S^2di	μ Mean	bi	S^2di	μ Mean	bi	S^2di
EC-620407	101.25	0.49	-13.13	4.99	1.04	-0.02	31.88	0.12	2.68**	5.00	2.65	0.06
EC-620428	105.19	-0.03	-1.66	5.32	0.79	-0.02	45.77	0.45	0.14	5.01	0.21	-0.03
EC-620360	105.76	0.38	-8.81	5.10	0.22	-0.02	49.11	0.22	2.87**	4.86	0.24	-0.01
EC-608415	89.18	0.21*	-13.71	4.79	0.21**	-0.03	44.44	1.23	-0.19	5.91	0.19	-0.04
EC-619982	88.49	0.57	-13.20	5.06	0.34	0.17*	54.88	0.54	4.54**	6.19	0.56	0.57**
Arka Saurabh	86.22	0.12	-13.42	5.46	0.77	-0.03	60.88	0.74	2.19**	4.20	0.20	-0.04
Arka Abha	93.38	0.68	-6.88	5.68	0.79	-0.01	49.44	0.38	2.34**	5.43	0.19*	-0.04
Punjab Chhuhara	91.41	0.34	22.03	7.10	1.84	0.06	42.55	0.51	-0.10	7.10	1.16	-0.03
Pusa Ruby	111.17	0.12	84.31**	6.53	1.56	0.37**	60.00	0.12	5.72**	4.93	0.46	-0.04
EC-520078	169.87	1.71	-12.69	5.64	0.63	-0.02	26.44	0.41	1.03	8.35	0.11	-0.04
EC-620557	134.59	1.26*	-13.99	5.59	0.60	0.08	41.22	0.48	0.58	5.64	0.51	-0.04
EC-620407 × Arka Saurabh	89.80	0.72	-13.85	4.63	1.94*	-0.02	40.88	0.77	0.92	5.45	0.77	-0.03
EC-620407 × Arka Abha	101.01	1.11	-1.49	5.46	0.68	0.03	39.00	0.80	1.57*	4.30	0.57	-0.05
EC-620407 × Punjab Chhuhara	90.70	0.73	-8.67	5.91	1.61	-0.02	36.00	0.74	5.01	6.04	1.14	-0.05
EC-620407 × Pusa Ruby	112.42	1.42	-2.17	5.45	1.24	-0.02	39.22	0.87	3.28**	4.77	0.57	-0.05
EC-620407 × EC-520078	179.99	1.61	-7.34	6.13	1.17	0.23**	26.77	0.41	10.83**	7.46	-0.17	-0.05
EC-620407 × EC-620557	129.48	1.14	-10.74	5.36	0.86	-0.02	36.33	0.38	0.48	5.41	0.97	-0.04
EC-620428 × Arka Saurabh	99.50	1.17	-10.61	5.11	1.09	-0.01	50.66	0.61	3.67**	4.61	1.64	-0.01
EC-620428 × Arka Abha	107.92	0.73	-10.60	5.53	1.19	-0.01	46.33	0.38	0.48	5.48	0.92	-0.04
EC-620428 × Punjab Chhuhara	95.31	1.33	-13.10	5.82	1.01	-0.02	42.77	0.67	2.89**	6.36	1.72**	-0.05
EC-620428 × Pusa Ruby	107.48	1.04	-13.58	5.83	1.71	-0.02	50.00	0.74	5.01**	5.14	0.61	-0.04
EC-620428 × EC-520078	193.48	0.43	128.78**	5.57	-0.57	-0.02	27.55	0.32	0.91	7.37	2.95	-0.04
EC-620428 × EC-620557	122.60	2.18	-0.64	4.76	1.67	0.00	42.11	0.74	8.88**	5.56	0.92	-0.05
EC-620360 × Arka Saurabh	115.66	1.84	-3.20	5.89	1.23	-0.03	54.66	0.64	2.02*	5.55	1.09	-0.05
EC-620360 × Arka Abha	106.07	1.47	-2.46	5.30	1.04	-0.03	46.88	0.70	3.88**	5.46	1.10	-0.05
EC-620360 × Punjab Chhuhara	111.55	1.95	-11.27	6.12	1.64*	-0.03	44.55	0.58	2.70**	7.10	2.28	-0.04
EC-620360 × Pusa Ruby	121.20	1.46	-12.72	6.38	2.09	-0.03	54.44	0.54	1.86*	5.12	1.18	-0.05
EC-620360 × EC-520078	168.00	0.80	25.33	5.57	0.02	0.02	27.33	0.67	10.17	7.59	2.03	-0.02
EC-620360 × EC-620557	148.54	1.87	-8.50	6.03	1.38	-0.03	45.77	0.54	1.86*	6.13	1.94**	-0.05
EC-608415 × Arka Saurabh	91.81	0.99	-13.93	5.64	0.95	-0.03	49.55	0.45	1.71*	5.82	1.01	-0.05
EC-608415 × Arka Abha	93.71	1.28*	-11.19	5.33	1.03	-0.01	46.55	0.45	1.71*	5.32	1.04	-0.05
EC-608415 × Punjab Chhuhara	93.17	1.71	-12.36	6.97	1.54	-0.03	41.33	0.38	0.48	6.71	2.16**	-0.05
EC-608415 × Pusa Ruby	126.85	0.95	-13.92	7.30	1.16	-0.03	49.66	0.48	2.52**	5.31	1.12	-0.05
EC-608415 × EC-520078	182.60	1.99	37.28	5.83	0.64	-0.03	27.77	0.09	0.06	8.15	0.91	-0.04
EC-608415 × EC-620557	152.56	1.51	-13.21	5.43	1.45	-0.03	38.77	0.67	2.89**	5.98	0.78	-0.04
EC-619982 × Arka Saurabh	84.96	0.89	7.22	5.70	0.70	-0.02	54.22	0.48	0.58	5.26	0.84	-0.05
EC-619982 × Arka Abha	101.31	1.28	-14.02	5.57	1.49	-0.03	60.77	6.07	276.92**	5.53	0.77	-0.05
EC-619982 × Punjab Chhuhara	101.53	1.30	8.07	7.18	1.57	-0.02	55.88	6.72	349.42**	6.95	1.13	-0.05
EC-619982 × Pusa Ruby	112.22	1.78	-11.90	7.08	1.56*	-0.03	61.11	3.31	57.04**	7.19	1.21**	-0.05
EC-619982 × EC-520078	186.55	-1.06	25.67	6.18	-1.00	-0.01	41.00	6.82	463.19**	7.92	0.45	-0.04
EC-619982 × EC-620557	128.77	1.82	0.81	5.47	1.45	-0.02	49.55	0.58	2.70**	6.18	0.92	-0.03
US-440	87.94	0.16	-8.86	5.26	0.53	-0.03	41.44	0.35	4.08**	6.50	1.32	0.04
Arka Rakshak	95.12	0.52	-13.80	5.47	0.35	-0.02	30.11	0.35	4.08**	5.78	1.07	-0.03
NS-516	84.03	0.01	-10.56	4.45	0.56	0.03	39.55	0.28	2.17**	5.06	0.38	-0.04
Mean	115.91	1.00		5.70	1.00		44.21	1.00		5.94	1.00	
SEM	2.60	0.30		0.12	0.49		1.23	1.95		0.11	0.38	
CD 5%	6.10			0.29			2.91			0.26		

*, ** Significant at 5 and 1% levels, respectively

Table 2: Stability parameters for number of fruits per cluster, fruit length, fruit width and average fruit weight.

Genotypes/Crosses	No. of fruits per cluster			Fruit length (cm)			Fruit width (cm)			Average fruit weight (g)		
	μ Mean	bi	S^2di	μ Mean	bi	S^2di	μ Mean	bi	S^2di	μ Mean	bi	S^2di
EC-620407	3.08	0.17	-0.04	5.79	4.18	0.12**	5.69	4.05	0.10**	74.31	1.27	0.76
EC-620428	3.85	0.41	-0.04	4.72	0.39	0.05*	4.88	0.44	0.03*	106.03	1.69	48.68**
EC-620360	3.17	0.62	0.02	5.05	0.31	0.06*	4.63	0.44	-0.01	65.69	0.97	-2.50
EC-608415	3.60	0.16	-0.03	3.71	0.34	-0.01	5.32	0.55	0.59**	74.30	0.99	18.34*
EC-619982	4.54	0.20	-0.02	5.28	0.87	0.40**	3.31	0.28	-0.01	58.51	0.18	11.79

Arka Saurabh	2.50	0.28	0.10	4.65	-0.70	0.02	4.87	1.30	-0.01	40.71	0.23	-4.41
Arka Abha	3.57	0.35	-0.04	3.48	0.50	-0.01	3.88	0.32	-0.01	48.49	0.30	1.66
Punjab Chhuhara	5.68	0.99	0.09	4.52	1.00	-0.01	4.14	0.55	-0.01	53.79	0.93	-3.93
Pusa Ruby	3.33	0.10	-0.04	2.75	0.61*	-0.01	4.69	0.59	-0.01	49.74	0.65	-4.37
EC-520078	7.06	0.56	-0.03	1.70	1.19	0.01	1.73	0.62	-0.01	1.398	0.01*	-4.90
EC-620557	4.51	0.91	0.02	5.51	0.88	0.22**	4.69	0.47	0.01	63.01	0.97	2.93
EC-620407 × Arka Saurabh	4.04	1.62	-0.03	4.73	0.65	-0.01	5.20	1.25	0.27**	75.38	0.86	-3.69
EC-620407 × Arka Abha	3.48	0.89	-0.04	5.27	3.95	0.01	4.65	2.39*	-0.01	78.64	1.84	-4.36
EC-620407 × Punjab Chhuhara	4.42	0.80	-0.02	4.84	0.88	-0.01	4.68	0.29	-0.01	60.78	1.16	-1.53
EC-620407 × Pusa Ruby	4.27	0.53	-0.01	4.09	0.87	-0.01	5.27	0.53	0.01	94.06	1.37	-0.64
EC-620407 × EC-520078	6.76	2.59	-0.03	2.15	0.47	-0.01	2.22	0.91	-0.01	6.02	0.10**	-4.91
EC-620407 × EC-620557	3.91	0.87	-0.04	5.67	0.90	-0.01	5.62	0.72	-0.01	74.46	1.01	4.16
EC-620428 × Arka Saurabh	3.43	0.94	0.03	5.04	0.69	-0.01	4.60	1.55	-0.01	88.44	1.54	0.80
EC-620428 × Arka Abha	3.40	0.48	-0.04	4.85	2.04	-0.01	4.73	0.82	-0.01	79.66	1.40	-4.10
EC-620428 × Punjab Chhuhara	4.54	1.69	-0.01	4.37	1.13	-0.01	4.05	1.00	0.00	59.77	1.06	-4.90
EC-620428 × Pusa Ruby	3.41	1.44	-0.01	4.73	0.80	-0.01	5.50	2.01	-0.01	75.17	0.66	24.34*
EC-620428 × EC-520078	6.24	3.82	0.74**	2.33	0.81	-0.01	2.28	0.86	-0.01	4.42	0.08*	-4.91
EC-620428 × EC-620557	3.79	2.25*	-0.03	5.66	1.25	-0.01	4.66	1.16	0.01	52.62	0.73	7.45
EC-620360 × Arka Saurabh	3.84	2.83	0.01	5.07	0.45	-0.01	4.46	0.70	-0.01	73.20	0.97	10.52
EC-620360 × Arka Abha	3.91	0.61	-0.03	4.83	1.66	-0.01	5.61	1.10	-0.01	75.50	-0.84	38.74**
EC-620360 × Punjab Chhuhara	4.44	1.53	-0.03	5.21	1.01	-0.01	5.25	1.55	-0.01	96.21	1.39	-4.22
EC-620360 × Pusa Ruby	3.46	1.76	-0.03	3.76	1.96	-0.01	5.53	1.45	-0.01	87.23	1.51*	-4.87
EC-620360 × EC-520078	6.10	3.93	0.00	2.97	0.93	-0.01	2.83	1.29	-0.01	3.49	0.05**	-4.91
EC-620360 × EC-620557	4.72	-1.00	-0.02	6.40	2.75	-0.01	5.38	1.17	-0.01	101.34	3.26	-3.00
EC-608415 × Arka Saurabh	4.05	0.62	-0.02	4.34	0.49*	-0.01	4.85	1.22	-0.01	61.88	0.89	4.06
EC-608415 × Arka Abha	4.17	0.59	-0.03	4.77	1.16	-0.01	6.27	1.97	0.05**	85.96	1.23	-4.40
EC-608415 × Punjab Chhuhara	4.85	0.90	-0.03	4.21	0.50	-0.01	4.55	0.63	-0.01	70.35	-0.11	3.39
EC-608415 × Pusa Ruby	4.13	1.34	-0.01	3.30	0.34	-0.01	4.26	0.72	-0.01	63.28	1.74	-4.24
EC-608415 × EC-520078	6.56	0.40	-0.03	3.01	1.29	-0.01	2.70	0.80	-0.01	3.78	0.03**	-4.91
EC-608415 × EC-620557	4.96	1.51	-0.03	4.34	0.59	-0.01	3.74	0.86	-0.01	68.60	0.69	-1.41
EC-619982 × Arka Saurabh	4.09	0.58	-0.03	5.09	0.86	-0.01	5.41	0.72	-0.01	66.60	1.72	-1.74
EC-619982 × Arka Abha	4.15	0.82	-0.03	4.52	1.57	-0.01	5.67	1.24	0.01	78.86	1.62	-2.12
EC-619982 × Punjab Chhuhara	5.07	1.07	-0.03	4.55	0.37	-0.01	4.32	0.91	-0.01	62.40	1.77	0.72
EC-619982 × Pusa Ruby	5.73	0.43	-0.02	4.22	0.79	-0.01	5.17	1.04	-0.01	81.71	2.08	-4.30
EC-619982 × EC-520078	6.27	0.46	-0.03	2.21	0.67	-0.01	2.27	0.71	-0.01	9.52	0.10*	-4.84
EC-619982 × EC-620557	4.12	0.59	-0.03	5.62	1.82	-0.01	4.54	0.83	-0.01	78.07	1.47	1.85
US-440	3.91	0.31	-0.00	3.90	0.25*	-0.01	4.62	2.14	0.03*	65.98	2.28**	-4.90
Arka Rakshak	4.45	1.22	-0.02	5.36	0.36	-0.01	5.23	0.91	-0.01	66.60	1.11	-3.86
NS-516	3.70	0.65	-0.02	5.41	-0.01	-0.01	4.11	-1.24	0.03*	77.44	0.83	-0.02
Mean	4.39	1.00		4.41	1.00		4.50	1.00		62.80	1.00	
SEM	0.13	0.43		0.11	0.79		0.12	0.98		1.82	0.45	
CD 5%	0.32			0.26			0.27			4.25		

** Significant at 5 and 1% levels, respectively

Table 3: Stability parameters for days to first fruit harvest, days to last fruit harvest, fruit yield per plant and pericarp thickness.

Genotypes/Crosses	Days to first fruit harvest			Days to last fruit harvest			Fruit yield per plant (kg)			Pericarp thickness (mm)		
	μ Mean	bi	S^2di	μ Mean	bi	S^2di	μ Mean	bi	S^2di	μ Mean	bi	S^2di
EC-620407	69.77	1.07	4.67**	117.44	0.91	-1.46	1.93	1.69	-0.01	5.05	2.81	0.03*
EC-620428	80.11	0.94	-0.10	126.00	0.58	10.24**	1.93	0.94	-0.01	3.86	0.58	0.01
EC-620360	81.55	0.97	0.88	131.33	0.95	-0.07	1.79	1.12	-0.01	4.37	0.79	0.01
EC-608415	76.88	0.80	1.01	125.33	1.03	0.94	1.94	0.87	-0.01	4.30	0.41	-0.01
EC-619982	88.44	1.14	1.43	139.66	1.08	-0.22	1.76	0.73	-0.01	3.81	-0.12	0.24**
Arka Saurabh	88.11	1.77	2.32*	126.88	0.48	4.82*	1.22	0.38*	-0.01	4.23	0.54	-0.01
Arka Abha	76.55	1.16	-0.50	116.55	0.91	2.08	1.30	-0.03	-0.01	4.47	0.39	-0.01
Punjab Chhuhara	80.33	0.59	-0.47	129.33	1.23	25.18**	1.43	0.29	-0.01	4.84	0.87	-0.01
Pusa Ruby	56.77	1.08	-0.46	122.11	0.94	-0.64	1.67	0.78	-0.01	2.82	0.93	-0.01
EC-520078	44.33	0.62	0.54	129.00	1.13	-1.00	1.13	0.16	-0.01	0.96	0.43*	-0.01
EC-620557	82.22	1.10	-0.41	130.88	0.69	-1.23	1.46	0.79	-0.01	4.55	1.97	0.20**
EC-620407 × Arka Saurabh	80.88	1.40	57.48**	131.66	1.18	-1.41	2.27	1.11	-0.01	4.63	0.85	1.05**
EC-620407 × Arka Abha	72.33	1.45	1.18	128.00	0.76	-1.32	2.28	1.76	-0.01	3.63	1.14	-0.01
EC-620407 × Punjab Chhuhara	76.55	0.83**	-0.51	137.77	0.78	-1.44	2.47	1.56	-0.01	4.40	0.61	-0.01
EC-620407 × Pusa Ruby	60.77	1.14	-0.08	118.00	0.76	-1.32	2.64	1.50	-0.01	3.58	0.43	-0.01
EC-620407 × EC-520078	54.00	0.99	-0.40	115.22	0.65*	-1.46	1.60	1.10	-0.01	1.24	1.41	-0.01
EC-620407 × EC-620557	74.00	0.99	-0.40	138.55	1.11	-1.45	2.19	0.81	-0.01	4.30	0.21	-0.01
EC-620428 × Arka Saurabh	83.77	0.81	-0.22	142.22	0.90	-1.44	2.12	1.26	-0.01	4.35	1.09	-0.01
EC-620428 × Arka Abha	74.11	1.08	-0.46	134.44	1.04	-1.46	2.02	1.38	-0.01	3.79	1.36	-0.01

EC-620428 × Punjab Chhuhara	76.55	0.93	-0.38	142.11	0.99	-1.24	2.15	0.95	-0.01	3.58	1.62	0.01
EC-620428 × Pusa Ruby	67.00	0.99	-0.40	129.00	0.76	-1.32	2.72	0.79	-0.01	3.13	0.23*	-0.01
EC-620428 × EC-520078	55.66	0.99	-0.40	121.33	0.97	-1.46	1.78	1.16	-0.01	1.74	4.45	0.13**
EC-620428 × EC-620557	74.00	0.99	-0.40	144.44	1.59	5.84*	2.25	1.74	-0.01	4.05	0.18	0.01
EC-620360 × Arka Saurabh	79.00	0.99	-0.40	139.77	1.44	0.47	2.40	2.64	-0.01	4.43	0.95	-0.01
EC-620360 × Arka Abha	77.00	0.99	-0.40	133.88	0.87	-0.51	1.91	1.52	-0.01	4.50	1.19	-0.01
EC-620360 × Punjab Chhuhara	79.00	0.99	-0.40	142.44	1.01	-0.87	2.83	0.88	-0.01	4.18	0.90	-0.01
EC-620360 × Pusa Ruby	65.66	0.99	-0.40	117.11	0.75	-1.05	3.13	0.26	-0.01	4.24	0.55	-0.01
EC-620360 × EC-520078	49.00	0.99	-0.40	125.11	0.75	-1.05	1.89	-2.59	0.038**	1.71	1.27	-0.01
EC-620360 × EC-620557	79.00	0.99	-0.40	142.00	1.34	3.86	2.51	0.98	-0.01	4.60	2.02*	-0.01
EC-608415 × Arka Saurabh	77.66	0.99	-0.40	132.33	0.97	-1.46	2.89	1.44	-0.01	4.02	1.02	-0.01
EC-608415 × Arka Abha	72.00	0.99	-0.40	129.77	1.17*	-1.46	3.29	0.26**	-0.01	4.03	0.03	-0.01
EC-608415 × Punjab Chhuhara	75.33	0.99	-0.40	137.11	0.83	-1.39	3.23	0.31**	-0.01	4.21	0.77	-0.01
EC-608415 × Pusa Ruby	62.33	0.76	-0.49	120.66	0.51	-1.40	2.74	1.50	-0.01	3.85	1.24	-0.01
EC-608415 × EC-520078	60.55	0.83**	-0.51	118.33	0.64	-1.37	1.99	1.33	-0.01	0.92	0.24	-0.01
EC-608415 × EC-620557	77.55	0.60	-0.28	135.77	1.24	1.44	2.85	0.21*	-0.01	4.74	0.61	-0.01
EC-619982 × Arka Saurabh	84.00	0.99	-0.40	135.55	0.90	-1.44	1.94	1.85	-0.01	4.61	0.22	-0.01
EC-619982 × Arka Abha	80.22	0.83**	-0.51	131.55	0.74	-0.63	2.23	0.76	-0.01	4.33	1.13	-0.01
EC-619982 × Punjab Chhuhara	77.33	0.82	-0.44	140.11	1.19	0.14	2.35	1.38	-0.01	3.96	1.51	-0.01
EC-619982 × Pusa Ruby	71.00	0.92	-0.50	126.55	1.35	2.68	2.53	1.73	-0.01	4.58	0.98	-0.01
EC-619982 × EC-520078	64.44	1.24	-0.44	126.44	0.72	0.64	2.02	1.12	-0.01	2.06	0.96	-0.01
EC-619982 × EC-620557	85.55	1.30	0.44	142.33	1.74	-1.27	3.04	0.26*	-0.01	4.73	2.76	-0.01
US-440	79.22	1.00	-0.51	137.77	1.94	-1.30	2.11	1.87	-0.01	3.46	-0.62	0.01
Arka Rakshak	65.33	0.49	-0.49	141.00	1.61	-1.32	2.95	2.61	-0.01	4.85	1.82	0.01
NS-516	81.88	1.30	0.63	116.77	0.64	0.69	2.00	0.68	-0.01	4.98	1.11	-0.01
Mean	73.13	1.00		130.70	1.00		2.20	1.00		3.83	1.00	
SEM	0.95	0.47		1.00	0.4		0.03	0.50		0.14	1.22	
CD 5%	2.21			2.31			0.08			0.33		

** Significant at 5 and 1% levels, respectively

Table 4: Stability parameters for fruit pH, total soluble solids, titrable acidity and ascorbic acid content.

Genotypes/Crosses	Fruit pH			Total soluble solids (°Brix)			Titrable acidity (%)			Ascorbic acid content (mg/100g)		
	μ Mean	bi	S^2di	μ Mean	bi	S^2di	μ Mean	bi	S^2di	μ Mean	bi	S^2di
EC-620407	4.08	1.27	0.00	4.23	0.55	-0.00	0.41	1.72	0.00*	16.90	1.94	0.36**
EC-620428	4.76	8.25*	-0.00	5.03	-0.88	0.00	0.37	-1.27*	0.00	23.32	4.63	0.89**
EC-620360	4.45	1.07	0.00	4.36	6.57	-0.00	0.42	2.15	0.01**	27.12	5.92	0.59**
EC-608415	5.05	4.57	0.00	4.75	16.96	0.03**	0.38	-0.21	0.00	18.35	2.07	0.11
EC-619982	4.40	3.30	0.00	4.72	3.54	0.01	0.35	-0.96	0.01**	24.44	-6.69	0.11
Arka Saurabh	4.48	2.34	0.00	4.26	1.38	0.00	0.37	-0.10	0.02**	23.42	3.39	2.53**
Arka Abha	4.51	1.91	0.00	4.31	0.88	0.00	0.42	1.47	0.02**	25.32	3.70	0.06
Punjab Chhuhara	4.37	2.78	0.00	4.11	-1.21	0.01	0.38	-0.38	0.01**	26.79	5.38	0.25*
Pusa Ruby	4.13	3.30	0.00	5.10	1.01	0.01	0.40	-0.15	0.02**	25.55	3.07	0.01
EC-520078	5.26	2.66	0.01**	6.08	-19.84	0.17**	0.37	2.47	0.01**	27.48	1.58*	-0.05
EC-620557	5.26	6.57	0.01*	5.11	2.40	-0.00	0.34	0.94	0.01**	16.58	1.74	0.05
EC-620407 × Arka Saurabh	4.37	-0.02	-0.00	4.38	0.46	0.00	0.40	3.72	0.06**	19.19	-0.11*	-0.05
EC-620407 × Arka Abha	4.39	-0.14	-0.00	4.37	1.90	0.00	0.44	0.41	0.00	21.65	-0.15*	-0.05
EC-620407 × Punjab Chhuhara	4.50	0.26	-0.00	4.34	5.25	0.02**	0.42	3.85	0.02**	22.58	-0.10*	-0.05
EC-620407 × Pusa Ruby	4.21	1.47	-0.00	4.72	-0.96	-0.00	0.42	0.35	0.01**	21.68	-0.15	-0.05
EC-620407 × EC-520078	4.72	-0.02	-0.00	5.28	-1.84	-0.00	0.43	-0.25	0.00	21.45	-0.04	-0.05
EC-620407 × EC-620557	4.77	-0.49	-0.00	4.73	0.24	-0.00	0.41	0.27	0.00	17.05	-0.22*	-0.05
EC-620428 × Arka Saurabh	4.74	-0.02	-0.00	4.76	0.77	0.00	0.43	0.16	0.00	24.17	-0.04*	-0.05
EC-620428 × Arka Abha	4.75	-0.20	-0.00	4.74	0.08	-0.00	0.44	0.69	0.00	25.13	-0.34*	-0.05
EC-620428 × Punjab Chhuhara	4.49	-0.40	-0.00	4.67	1.11	0.00	0.41	0.38	0.00*	26.16	-0.76	0.01
EC-620428 × Pusa Ruby	4.55	-0.40	0.00	5.12	0.78	0.03**	0.43	0.74	0.00*	25.08	0.39	0.01
EC-620428 × EC-520078	5.08	-0.43	-0.00	5.58	-6.79	0.00	0.42	0.52	0.00	24.80	-1.02**	-0.06
EC-620428 × EC-620557	5.13	0.98	-0.00	5.05	15.22	0.00	0.40	0.77	0.00	20.50	-0.77*	-0.05
EC-620360 × Arka Saurabh	4.58	0.78	-0.00	4.35	1.15	-0.00	0.43	3.16	0.03**	26.05	0.26	0.02
EC-620360 × Arka Abha	4.56	0.03	0.00	4.42	3.32	-0.00	0.46	3.30	0.03**	27.16	-0.08	-0.05
EC-620360 × Punjab Chhuhara	4.52	1.36	-0.00	4.31	0.17	-0.00	0.45	2.41	0.01**	28.09	0.06	-0.05
EC-620360 × Pusa Ruby	4.39	1.91	-0.00	5.37	0.47	-0.00	0.39	1.50	0.01**	27.21	-0.06	-0.05
EC-620360 × EC-520078	4.89	-0.98	0.00	5.45	2.04	0.01	0.43	2.77	0.02**	27.03	-0.38*	-0.06
EC-620360 × EC-620557	4.95	-0.08	0.00	4.81	-0.71	0.00	0.43	1.88	0.01*	22.55	-0.76*	-0.06
EC-608415 × Arka Saurabh	4.87	0.14	-0.00	4.70	0.40	0.01	0.42	1.19	0.00	21.42	-0.14*	-0.06
EC-608415 × Arka Abha	4.87	-0.26	-0.00	4.71	-0.52	0.00	0.45	1.76	0.00	22.38	-0.17*	-0.06
EC-608415 × Punjab Chhuhara	4.81	0.20	-0.00	4.59	1.13	0.00	0.42	-0.44	0.00	23.52	1.85*	-0.06
EC-608415 × Pusa Ruby	4.69	0.46	-0.00	5.14	2.18	0.00	0.43	0.18	0.00*	22.42	-0.16*	-0.06
EC-608415 × EC-520078	5.19	1.65	-0.00	5.57	2.82	-0.00	0.40	0.37	0.02**	22.23	-0.25*	-0.06

EC-608415 × EC-620557	5.24	1.96	-0.00	5.14	1.70	0.01*	0.38	0.94	0.05**	17.76	-0.50*	-0.06
EC-619982 × Arka Saurabh	4.54	-0.55	-0.00	4.63	-0.37	0.00	0.40	0.49	0.00*	23.42	-0.57*	-0.06
EC-619982 × Arka Abha	4.50	-0.58	0.01*	4.68	-0.90	0.00	0.42	0.82	0.00*	24.52	-0.85	-0.00
EC-619982 × Punjab Chhuhara	4.48	-0.17	-0.00	4.55	0.11	0.01	0.41	0.38	0.00	25.42	-0.89	-0.02
EC-619982 × Pusa Ruby	4.35	-0.86	-0.00	5.09	1.79	0.01	0.39	1.06	0.04**	24.44	-0.43*	-0.06
EC-619982 × EC-520078	4.89	-0.40	0.01*	5.83	-0.77*	-0.00	0.39	1.03	0.04**	23.66	-5.72**	-0.06
EC-619982 × EC-620557	4.94	-0.87	0.00	4.92	2.64	0.01*	0.37	1.05	0.05**	22.69	25.02**	-0.05
US-440	4.94	-1.73	-0.00	4.67	1.09	0.01	0.42	1.80	0.07**	17.74	-0.00	-0.06
Arka Rakshak	4.78	4.05	-0.00	5.07	-1.77	0.06**	0.36	-0.38	0.00	23.86	5.25	2.46**
NS-516	4.54	-0.66	0.02**	4.34	0.38	-0.00	0.35	1.32	0.01**	18.39	-0.81	0.04
Mean	4.68	1.00		4.82	1.00		0.41	1.00		23.11	1.00	
SEM	0.03	2.03		0.08	5.66		0.03	1.78		0.31	1.59	
CD 5%	0.07			0.18			0.07			0.72		

*, ** Significant at 5 and 1% levels, respectively

Table 5: Stability parameters for reducing sugars, total sugars and lycopene content.

Genotypes/Crosses	Reducing sugars (%)			Total sugars (%)			Lycopene content (mg/100g)		
	μ Mean	bi	S^2di	μ Mean	Bi	S^2di	μ Mean	bi	S^2di
EC-620407	3.24	1.19	0.01*	3.55	0.65	-0.00	6.04	1.74	0.01
EC-620428	2.88	0.95	-0.00	3.35	0.50	0.00	7.27	2.17	0.15**
EC-620360	2.88	1.03	0.00	3.71	0.49	0.00	6.81	2.41	0.04**
EC-608415	3.52	2.22	0.03**	3.96	0.43	0.04**	6.42	1.89	0.16**
EC-619982	3.73	1.15	0.02**	4.16	0.54*	-0.00	7.98	2.17	0.01
Arka Saurabh	2.77	1.06	0.00	3.65	0.42**	-0.00	5.06	0.21	-0.00
Arka Abha	2.43	0.93	-0.00	3.23	0.37	0.00	5.76	0.30	-0.00
Punjab Chhuhara	3.22	1.37	0.00	3.61	0.56	0.00	6.53	0.96	-0.00
Pusa Ruby	2.36	0.81	-0.00	2.81	0.23	0.00	6.09	0.15	-0.00
EC-520078	1.58	0.49	0.00	2.12	0.17	0.00	8.57	2.26	-0.00
EC-620557	3.71	1.87	0.01**	4.23	0.44	0.00	8.02	2.62	0.03**
EC-620407 × Arka Saurabh	3.08	0.62	0.00	3.69	0.22	0.00	5.88	0.45	-0.00
EC-620407 × Arka Abha	2.60	1.02	0.00	3.33	0.06	-0.00	6.11	0.82	-0.00
EC-620407 × Punjab Chhuhara	2.87	0.96	0.00	3.65	0.49	0.00	6.57	0.57	0.00
EC-620407 × Pusa Ruby	2.50	0.95	0.00	3.17	0.21	0.00	6.26	0.34*	-0.00
EC-620407 × EC-520078	1.81	0.95	0.00	2.54	0.56	0.00	8.59	0.67	0.00
EC-620407 × EC-620557	3.44	1.31	-0.01	4.16	0.40	0.00	7.43	1.02	0.00
EC-620428 × Arka Saurabh	2.93	0.82	-0.00	3.59	0.67	0.00	6.40	1.07	0.00
EC-620428 × Arka Abha	2.71	0.99	0.00	3.42	0.40	0.00	6.66	0.66	0.01
EC-620428 × Punjab Chhuhara	2.94	1.02	0.00	3.66	0.38	0.00	7.31	0.66	-0.00
EC-620428 × Pusa Ruby	2.77	-3.06	0.13**	3.59	-2.97	0.64**	6.97	0.66	-0.00
EC-620428 × EC-520078	1.93	0.90	0.00	2.56	0.26	0.00	8.42	0.83	-0.00
EC-620428 × EC-620557	3.53	1.22	0.00	4.24	0.61	0.00*	8.22	0.50*	-0.00
EC-620360 × Arka Saurabh	2.99	0.92	0.00	3.69	0.45	0.00	6.23	0.48	-0.00
EC-620360 × Arka Abha	3.05	1.31	0.00	3.95	3.16*	0.00	6.57	0.65*	-0.00
EC-620360 × Punjab Chhuhara	2.98	0.97	0.00	3.85	3.17*	-0.00	7.05	0.82	-0.00
EC-620360 × Pusa Ruby	2.90	0.93	0.00	4.12	8.28	0.01**	6.63	0.56	-0.00
EC-620360 × EC-520078	1.59	0.69	0.00	3.25	14.31	0.05**	8.18	0.28	-0.00
EC-620360 × EC-620557	3.46	1.10	-0.00	4.02	0.47	0.10**	8.06	0.36	0.04**
EC-608415 × Arka Saurabh	3.23	1.19	0.00	3.88	0.53	0.00	5.94	0.87	-0.00
EC-608415 × Arka Abha	2.97	0.98	0.00	3.62	0.40	-0.00	6.32	0.69	-0.00
EC-608415 × Punjab Chhuhara	3.08	0.85	-0.00	3.77	0.49	0.00	6.83	0.75	-0.00
EC-608415 × Pusa Ruby	3.14	0.84	0.00	3.78	0.65	0.00*	6.56	1.21	0.00
EC-608415 × EC-520078	1.51	1.08	0.00	2.10	0.51	0.00	7.88	0.84	-0.00
EC-608415 × EC-620557	3.36	1.11	-0.00	4.06	0.49*	-0.00	7.67	0.92	0.01
EC-619982 × Arka Saurabh	3.64	1.44	-0.00	4.28	0.69	0.10**	6.84	0.85	-0.00
EC-619982 × Arka Abha	3.14	0.97	0.00	3.87	0.33	-0.00	7.12	0.87	-0.00
EC-619982 × Punjab Chhuhara	3.17	0.73	0.00	3.69	0.61	0.00*	7.57	0.02	0.01
EC-619982 × Pusa Ruby	3.25	1.07	-0.00	3.89	0.45	0.00	7.39	0.44	-0.00
EC-619982 × EC-520078	1.95	1.20	0.00	2.59	0.56	0.00	8.72	0.39	-0.01
EC-619982 × EC-620557	3.58	1.46	-0.00	4.30	0.76	0.01**	8.60	-0.01	0.00
US-440	3.20	1.00	0.00	3.89	0.36	0.00	6.50	0.73	-0.00
Arka Rakshak	2.98	0.29	-0.00	3.68	0.95	-0.00	8.27	4.83	0.12**
NS-516	3.06	2.88	0.01**	3.60	0.07	0.00	6.54	2.16	-0.00
Mean	2.90	1.00		3.59	1.00		7.06	1.00	
SEM	0.05	0.86		0.09	0.74		0.09	0.40	
CD 5%	0.11			0.22			0.21		

*, ** Significant at 5 and 1% levels, respectively

Table 6: Analysis of Variance for stability

Source of variation	df	Plant height (cm)	Number of primary branches per plant	Days to 50% flowering	Number of flowers per cluster	Number of fruits per cluster	Fruit length (cm)	Fruit width (cm)	Average fruit weight (g)	Days to 1st fruit harvest	Days to last fruit harvest
Replications within Environment	6.00	6.13	0.03	0.26	0.08*	0.04	0.01	0.00	7.34	0.56	2.04
Genotypes	43.00	2798.00**	1.36**	277.57**	3.22**	3.38**	3.52**	3.33**	2182.24**	319.58**	223.92**
Environments + (Genotypes × Environments)	88.00	90.18**	0.11**	27.63	0.14**	0.21**	0.05**	0.04	28.65**	5.12**	8.34**
Environments	2.00	2516.37**	2.92**	166.57**	3.83**	4.44**	0.88**	0.65**	713.15**	176.42**	292.83**
Genotypes × Environments	86.00	33.76**	0.04	24.40	0.05**	0.11**	0.03	0.02	12.73*	1.14	1.72
Environments (Linear)	1.00	5032.75**	5.85**	333.14**	7.67**	8.89**	1.76**	1.30**	1426.30**	352.83**	585.66**
Genotypes × Environments (Linear)	43.00	53.45**	0.05	19.16	0.08**	0.18**	0.03	0.02	18.64**	0.42	1.41
Pooled Deviation	44.00	13.74	0.03	28.97**	0.03	0.04	0.02**	0.03**	6.67	1.81**	1.98
Pooled Error	258.00	14.22	0.03	0.38	0.05	0.04	0.01	0.01	4.86	0.52	1.46
Total	131.00	979.00	0.52	109.67	1.15	1.25	1.19	1.12	735.56	108.34	79.10

Table 6: Count…

Source of variation	d.f.	Fruit yield per plant (kg)	Pericarp thickness (mm)	Fruit pH	Total soluble solids (° Brix)	Titrable acidity (%)	Ascorbic acid content (mg/100g)	Total sugars (%)	Reducing sugars (%)	Lycopene content (mg/100 g)
Replications within Environment	6.00	0.00	0.01	0.00	0.00	0.00	0.08	0.00	0.00	0.01
Genotypes	43.00	0.88**	3.50**	0.28**	0.61**	0.00	29.99**	0.88**	0.98**	2.52**
Environments + (Genotypes × Environments)	88.00	0.01**	0.04	0.00	0.01	0.00	0.85**	0.13**	0.01	0.10**
Environments	2.00	0.21**	0.60**	0.01**	0.01	0.01**	1.68**	0.73**	0.15**	2.21**
Genotypes × Environments	86.00	0.00*	0.03	0.00	0.01	0.00	0.84**	0.11**	0.00	0.05**
Environments (Linear)	1.00	0.43**	1.20**	0.02**	0.02	0.02**	3.35**	1.47**	0.31**	4.41**
Genotypes × Environments (Linear)	43.00	0.01**	0.02	0.00	0.01	0.00	1.47**	0.21**	0.00	0.08**
Pooled Deviation	44.00	0.00	0.04**	0.00*	0.01**	0.00**	0.19**	0.02**	0.01**	0.02**
Pooled Error	258.00	0.00	0.01	0.00	0.00	0.00	0.06	0.00	0.00	0.00
Total	131.00	0.30	1.18	0.09	0.21	0.00	10.42	0.38	0.33	0.89

*, ** significant at 5 and 1 % levels, respectively

Conclusion

From the present study it is evident that the crosses as a whole exhibited higher mean values with regression coefficients around unity, indicating greater production and stability of crosses for fruit yield. The stability of the genotypes for fruit yield has also been reported to be the result of stability for its component traits (Grafius, 1956). The stable crosses for growth, earliness, yield and quality involved either one or both stable parents. Rai *et al,* (1998), Mandal *et al,* (2000) and Ivi Chakraborty *et al,* (2007) had suggested the utilization of stable and potential genotypes in breeding programmes for incorporation of stability as the relative stability of the crosses was associated with the stability of parents. The cross EC-608415 × Arka Abha besides yield exhibited stable performance for other yield contributing characters like fruit width, average fruit weight and quality traits like total sugars, total soluble solids, reducing sugars and ascorbic acid. Cross EC-608415 × Punjab Chhuhara was also found to be stable for plant height, fruit width, average fruit weight and quality components while EC-620360 × Pusa Ruby exhibited stability for plant height, number of primary branches, average fruit width, days to last fruit harvest, fruit pH, total and reducing sugars and EC-619982 × EC-620557 manifested stability for number of fruits per cluster, number of flowers per cluster, fruit length, fruit width, average fruit weight, total sugars, reducing sugars and lycopene content.It can be concluded that certain hybrids expressed stability for different characters and the study was confined to one location. To get more realistic information on stability, the identified genotypes should be evaluated across the locations and over years before the commercial release.

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