

Combining ability analysis for yield and quality traits in tomato (*Solanum lycopersicum* L.)

Comment [U1]: Topic is okay

Abstract

In order to assess the general and specific combining ability (GCA & SCA) in tomato for fruit production and quality attributes, fourteen parental lines were crossed in a line x tester mating design with eleven line and three tester at M.E.S department of vegetable science ANDUAT, Ayodhya. Combining ability analysis showed that the majority of characteristics were influenced by both additive and non-additive gene action, and that heterosis breeding had improved these traits. The best general combiner for yield and its crucial component was determined to be the line NDT-4 and the testers Kashi chayan based on GCA effects of parents. For increasing fruit yield per plant, the crosses NDT-2 and Arka vikash are superior specific combiners.

Comment [U2]: Write in full

Key words: Tomato, Combining ability, Quality, Yield.

Introduction

Because of its vast range of adaptability and versatility, tomatoes are a key vegetable crop. They are cultivated both outdoors and inside all over the world, and in many nations, including India, they are considered to be second only to potatoes in terms of importance. In India, the total area was 0.789 million hectares, and the productivity was 25.042 tonnes per hectare with a yield of 19.759 million tonnes (Anonymous, 2018). The top producing states of tomatoes in India include Karnataka, West Bengal, Maharashtra, Uttar Pradesh, Haryana, Punjab, Gujarat, and Bihar. It is widely grown as an annual plant all over the world and is considered to be "Protective Food" by all. In many nations, including India, tomato is second in importance only to potato (Bose and Som 1993). It is a member of the solanaceae family and is indigenous to Peru and Ecuador (Rick 1969). According to (Dhaliwal et.al), it is a rich source of vitamins A and C, minerals including calcium, phosphorus, and iron, as well as a significant source of antioxidants such phenolics, ascorbic acid (vitamin C), carotenoids (particular rly lycopene and Beta carotene), and a tiny amount of vitamin E. (Rai et. al., 2012)

Comment [U3]: Background limited to india

Crop improvement programmers must know how much general combining ability (GCA) and specialized combining ability (SCA) exist in parents and F_1 crosses, respectively (Sprague and Tatum, 1942). GCA exposes the presence of gene effects that are additive, whereas SCA reveals gene effects that are non-additive. Knowledge of GCA effects is helpful

for selecting the optimal combiner parents, while SCA effects disclose the best cross combinations for further evaluation.

Comment [U4]: Inadequate updated literature

Materials and Method

In order to produce 33 F₁ hybrid combinations during the rabi seasons of 2020-21 and 2021-22 at the department of vegetable science's main experiment station, the fundamental materials-eleven lines (females) and three testers (males) were crossed in a line tester method. A randomised block design with three replications was used to raise the hybrid and the parents. Five randomly chosen plants from each replication were observed at each site. Ten plants were raised in each replication row to row, with a plant to plant spacing of 60×50 cm. To develop a healthy crop, conventional agronomic and plant protection practises were used. The following qualities were noted in the data: Days to 50% flowering, days to first fruit harvest, plant height (cm), number of primary branches per plant, number of fruits per cluster, number of fruits per plant, average fruit weight (g), pericarp thickness (mm), number of locules per fruit, polar diameter of fruit (cm), equatorial diameter of fruit (cm), tss (⁰Brix), titrable acidity (per cent), ascorbic acid (mg per 100g fresh fruit), and (mg per 100g fresh fruit). Analysis of variance was performed on the data that were obtained. The Griffing (1956) approach was used to analyze general and specialized combining abilities, and its impacts were calculated.

Result and Discussion:

The average results from the eleven lines and three testers used in this study showed that there were highly significant differences between all genotypes for all observed traits, with the exception of days to first fruit harvest, primary branches per plant, locules per fruit, lycopene, and total soluble solids, which showed the greatest significant differences. With the exception of the days until 50% flowering, the days until the first fruit harvest, the locules per fruit, and the average fruit weight, the tester revealed significant variations for all of the attributes. All 33 F₁ showed highly significant variances across all attributes. (Table-1)

Estimation of general combining ability (GCA) provides basic and important information for exploiting genetic potential of parents for development of superior and elite lines. As expression of significant and high GCA effects of a parent line reflects the presence of favorable additive genetic effects that leads to selection in early generation for developing widely adopted hybrids (Roy *et al.* 2002). Estimation of GCA effects of line testers represented that no single line or tester exhibited good general combining ability for all the traits (Table-2). The lines with the highest values of GCA effects were NDT-4 for total fruit

yield per plant, titrable acidity, polar diameter, and plant height, NDT-5 for total sugar, lycopene, and line NDT- Sel-8 for days to 50% flowering, no of fruit per cluster, and ascorbic acid had the highest GCA effects for all other traits. Similar to the other test plants, Kashi chayan had the highest GCA effects for total fruit yield, lycopene, total solid, marketable fruit yield, pericarp thickness, average fruit weight, number of fruits per plant, number of fruits per cluster, kashi aman for plant height, number of primary branches per plant, number of locules per fruit, total soluble solid and equatorial diameter of fruit, while arka vikash had the highest GCA effects for all other traits. These findings demonstrated that tester Kahi Chayan and line NDT-4 had the greatest favourable GCA effects for the majority of the characteristics, making them suitable parents for use in upcoming breeding programmes. According to research by Premalatha *et al.* (2006) and Harer & Bapat (1982), high GCA effects are caused by additive gene activity and additive x additive gene interaction.

The basic requirement for hybrid development is the accumulation of additive gene effects for desired traits, and hybrids with high SCA effects of various traits involving either one or both of the parents with good GCA indicate the preponderance of additive genetic effects, while hybrids with significant and positive SCA involving the parents with low or non-significant GCA showed the value of non-additive genetic effects. Due to the interaction of dominant alleles from good combiners and receive alleles from poor combiners, many hybrids exhibit high substantial SCA effects in general combining combinations of high x lower and high x high (Roy *et al.*). One hybrid did not exhibit any significant superior SCA impacts for any of the examined attributes. Significant superior SCA effects for all observed traits were not shown by single hybrid. Cross $L_2 \times T_1$ exhibited significant SCA effect for total fruit yield per plant, cross $L_{10} \times T_1$ showed the earliness and crosses $L_7 \times T_2$, $L_7 \times T_3$, $L_3 \times T_1$, $L_2 \times T_1$, $L_2 \times T_3$, $L_1 \times T_1$, $L_6 \times T_1$, $L_6 \times T_2$, $L_6 \times T_3$, $L_8 \times T_2$, showed the highest significant SCA effects for plant height, marketable fruit yield, fruit per cluster, total fruit yield per plant, fruit per cluster, total soluble solid, average fruit weight, locules per fruit, total sugar, ascorbic acid content, equatorial diameter respectively. (table-3). So this hybrid can be used in future breeding programme, these results are also in accordance with the study of Sharma *et al.* (2002). Chisti *et al.* (2007) and saleem *et al.* (2009).

Table- 1 Analysis of variance for combining ability following line × tester mating design for eighteen characters in tomato (Y₁ and Y₂) & Pooled

Source of variation	Year	DF	Days to 50% flowering	Days to First Fruit harvest	Plant height	Primary Branches/Plant	Pericarp thickness	Locules/Fruit	Fruit/Cluster	Fruit/Plant	Avg. fruit weight
Replicates	Y1	2	39.636	4.45	81.272 *	0.259 *	0.002	0.299 **	0.046	2.961	993.980 **
	Y2	2	33.495**	4.01	43.37	0.322	0.001	0.121**	0.788**	7.859	290.263 **
	Pooled	2	8.25**	2.06	60.620 **	0.003	0.001	0.131 **	0.284 **	5.102 *	572.487 **
Crosses	Y1	32	16.58	28.04	166.553 **	1.813 **	0.017 **	0.317 **	0.467 **	42.098 **	262.526 **
	Y2	32	12.093**	25.995**	106.371**	1.236**	0.014 **	0.223**	0.366 ***	46.889**	302.139 **
	Pooled	32	18.71**	27.60**	116.780 **	1.451 **	0.014 **	0.231 **	0.406 **	43.251 **	279.550 **
Line Effect	Y1	10	31.85	36.25	360.461 **	0.568	0.047 **	0.36	0.815 *	59.329 **	802.360 **
	Y2	10	23.632*	28.984	233.339 **	0.364	0.024**	0.348	0.581 *	61.594	893.466 **
	Pooled	10	31.11	33.85	274.553 **	0.340	0.032 **	0.28	0.680 *	59.434 **	845.981 **
Tester Effect	Y1	2	3.76	9.58	444.894 **	13.212 **	0.021 **	0.39	0.888 *	278.675 **	32.49
	Y2	2	1.404	7.101	146.097 *	9.280 **	0.042 **	0.295	0.874*	242.242**	73.174
	Pooled	2	4.57	3.18	271.413 **	11.108 **	0.031 **	0.33	0.876 *	258.573 **	49.88
Line × Tester Effect	Y1	20	10.22	25.78	41.766 **	1.296 **	0.002 *	0.290 **	0.251 **	9.824 **	15.61
	Y2	20	7.393**	26.390**	38.915	0.867**	0.006**	0.154**	0.207**	19.801**	29.371
	Pooled	20	13.92**	26.91**	22.430 *	1.041 **	0.003 **	0.197 **	0.222 **	13.627 **	19.3
Error	Y1	64	2.61	6.98	17.4	0.08	0.00	0.02	0.04	2.65	28.94
	Y2	64	2.412	1.958	25.463	0.185	0.00	0.001	0.05	3.444	29.18
	Pooled	64	0.03	1.41	10.38	0.07	0.00	0.01	0.02	1.55	26.27
Total	Y1	98	7.92	13.80	67.41	0.65	0.01	0.12	0.18	15.53	124.91
	Y2	98	6.207	9.849	52.248	0.531	0.005	0.076	0.168	17.72	123.638
	Pooled	98	6.30	9.97	46.15	0.52	0.01	0.08	0.15	15.24	120.12

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Source of variation	Year	DF	Polar diameter	Equitorial diameter	Total fruit yield/Plant	Marketable fruit yield/Plant	Total soluble solids	Titration acidity	Ascorbic acid content	Total Sugar	Lycopene
Replicates	Y1	2	0.136	0.127	1.002**	0.010 **	0.166 *	0.002 *	0.949 **	0.060 **	0.074
	Y2	2	0.863 **	1.138 **	0.453**	0.002	0.041	0.001	1.583	0.054	0.038
	Pooled	2	0.392 **	0.194 *	0.680 **	0	0.075 *	0	0.560 *	0.031 *	0.03
Crosses	Y1	32	0.775 **	0.697 **	0.417 **	0.122 **	0.964 **	0.015**	5.836 **	0.029 **	0.275 **
	Y2	32	0.524 **	0.646 **	0.410**	0.093**	0.971 **	0.012 **	5.833 **	0.114 **	0.597 **
	Pooled	32	0.575 **	0.666 **	0.404 **	0.101 **	0.958 **	0.013 **	5.003 **	0.050 **	0.379 **
Line Effect	Y1	10	1.980 **	1.534 **	0.824 **	0.330 **	0.72	0.042 **	12.088 **	0.054 **	0.16
	Y2	10	1.285 **	1.415 **	0.833 **	0.240**	0.788	0.036 **	9.139 *	0.251 **	0.558
	Pooled	10	1.543 **	1.465 **	0.822 **	0.280 **	0.74	0.038 **	9.277 **	0.104 **	0.3
Tester Effect	Y1	2	0.46	0.03	1.824 **	0.02	0.62	0.009 **	24.197 **	0.094 **	2.812 **
	Y2	2	0.024	0.012	1.390 **	0.033	1.041	0.008 **	16.054 *	0.07	3.781 **
	Pooled	2	0.17	0.02	1.589 **	0.02	0.80	0.008 **	19.924 **	0.072 *	3.236 **
Line × Tester Effect	Y1	20	0.203 **	0.345 **	0.07	0.029 **	1.120 **	0.002 **	0.874 **	0.011 **	0.078 **
	Y2	20	0.194 *	0.325**	0.100 *	0.025 **	1.056 **	0.001**	3.159 **	0.050 *	0.298 **
	Pooled	20	0.131 **	0.332 **	0.077 **	0.020 **	1.082 **	0.001 **	1.374 **	0.020 **	0.131 **
Error	Y1	64	0.06	0.07	0.05	0	0.04	0	0.01	0	0.03
	Y2	64	0.091	0.009	0.046	0.009	0.061	0.00	0.659	0.024	0.03
	Pooled	64	0.04	0.05	0.03	0	0.02	0	0.16	0.01	0.02
Total	Y1	98	0.29	0.28	0.19	0.04	0.35	0.01	1.93	0.01	0.11
	Y2	98	0.25	0.29	0.173	0.036	0.358	0.004	2.368	0.054	0.215
	Pooled	98	0.248	0.294	0.17	0.04	0.33	0	1.75	0.02	0.14

Table-2 Estimates of general combining ability (gca) effects of parents (lines and testers) for eighteen characters in tomato over two years (Y₁, Y₂) and pooled

Traits	Days to 50 % flowering			Days to first fruit harvest			Plant height		
	Y ₁	Y ₂	Pooled	Y ₁	Y ₂	Pooled	Y ₁	Y ₂	Pooled
NDT-Sel-1	1.899 **	1.657 **	0.394**	1.545	0.626	1.253 **	2.646 *	0.573	2.646 *
NDT-Sel-2	1.788 **	1.434 *	-0.273 **	2.657 **	2.626 **	2.697 **	0.391	-1.45	0.391
NDT-Sel-3	0.899	0.879	-1.606**	-0.455	-0.818	-0.747	-5.824 **	-4.459 **	-5.824 **
NDT-4	0.899	0.768	2.061**	-0.01	0.071	-0.025	9.379 **	9.381 **	9.379 **
NDT-Sel-5	2.232**	1.990 **	3.061**	-0.677	-0.152	-0.247	5.653 **	5.175 **	5.653 **
NDT-Sel-6	0.455	0.212	1.061**	3.990 **	3.626 **	3.864 **	-5.430 **	-5.259 **	-5.430 **
NDT-7	-0.768	-0.788	0.394**	-1.01	-0.707	-0.636	-5.441 **	-4.920 **	-5.441 **
NDT-Sel-8	- 2.545**	- 2.566* *	-1.439**	-3.121 **	-2.818 **	-2.914 **	-2.227 *	-0.767	-2.227 *
NDT-Sel-9	0.455	0.434	1.394**	-1.455	-1.374 *	-1.581 **	-2.624 *	-4.348 **	-2.624 *
NDT-Sel-10	- 2.212**	-1.455*	-2.273**	-0.343	-0.818	-1.303 **	-4.053 **	-0.988	-4.053 **
T6	- 3.101**	-2.566 **	-2.773**	-1.121	-0.263	-0.359	7.530 **	7.060 **	7.530 **
SE (g _i) lines	0.6105	0.5803	0.0895	0.9534	0.5321	0.4577	1.42	1.15	1.09
SE(g _i - g _j)	0.8633	0.8207	0.1266	1.3483	0.7525	0.6473	2.01	2.19	1.54
Testers									
Arka vikash	0.303	0.232	0.318**	-0.606	-0.354	-0.359	-3.247 **	-2.279 **	-3.247 **
Kashi chayan	-0.364	-0.162	-0.409**	0.182	0.525	0.187	1.059	0.411	1.059
Kashi aman	0.061	-0.071	0.091	0.424	-0.172	0.172	2.187 **	1.868 *	2.187 **
SE (g _i)	0.4509	0.3031	0.0467	0.4979	0.2779	0.2390	0.71	0.81	0.57
SE (g _i -g _j)	0.3188	0.4286	0.0661	0.7041	0.3930	0.3381	1.05	1.14	0.8

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Traits	No. of primary branches/plant			Number of fruits per cluster			Number of fruit per plant		
	Y ₁	Y ₂	Pooled	Y ₁	Y ₂	Pooled	Y ₁	Y ₂	Pooled
NDT-Sel-1	0.249**	0.264	0.249**	0.413**	0.196 *	0.303 **	0.006	-0.666	-0.33
NDT-Sel-2	-0.007	0.12	-0.007	-0.107	-0.092	-0.1	-0.915	-0.054	-0.484
NDT-Sel-3	0.309**	0.371**	0.309**	-0.293**	-0.276**	-0.284 **	-2.618 **	-2.973**	-2.793 **
NDT-4	-0.172*	-0.155	-0.172 *	-0.14	-0.084	-0.112	1.532 **	2.019**	1.774 **
NDT-Sel-5	-0.146	-0.05	-0.146	-0.253 **	-0.152	-0.203 **	-1.458 **	-1.904**	-1.681 **
NDT-Sel-6	0.176*	0.198	0.176 *	0.11	0.148	0.130 *	-1.287 *	-0.8	-1.047 **
NDT-7	-0.236**	-0.131	-0.236**	0.363 **	0.398**	0.381 **	-0.149	0.486	0.168
NDT-Sel-8	0.16	-0.121	0.16	0.440 **	0.346**	0.393 **	-1.242 *	2.304**	-1.772 **
NDT-Sel-9	-0.172*	-0.162	-0.172 *	-0.447 **	-0.422**	-0.433 **	-1.278 *	-0.404	-0.840 *
NDT-Sel-10	-0.163	-0.208	-0.163	0.037	0.047	0.041	0.428	-0.114	0.156
T6	0.003	-0.125	0.003	-0.123	-0.108	-0.116	6.980 **	6.715**	6.850 **
SE (g _i) lines	0.09	0.13	0.08	0.09	0.0074	0.06	0.5	0.03	0.38
SE(g _i - g _j)	0.31	0.19	0.11	0.12	0.01	0.08	0.71	0.04	0.54
Testers									
Arka vikash	-0.660**	-0.609**	-0.660**	0.098 *	0.088	0.093 **	0.169	-0.469	-0.149
Kashi chayan	0.228**	0.252**	0.228**	0.092	0.100 *	0.095 **	2.818**	2.925**	2.871 **
Kashi aman	0.431**	0.357**	0.431**	-0.189 **	-0.188**	-0.188**	-2.987 **	2.455**	-2.722 **
SE (g _i)	0.04	0.07	0.04	0.04	0	0.03	2.26	0.01	0.2
SE (g _i -g _j)	0.06	0.09	0.06	0.06	0	0.04	0.37	0.02	0.28

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TraitS	Average fruit weight			Pericarp thickness			No. of locules per fruit		
	Y ₁	Y ₂	Pooled	Y ₁	Y ₂	Pooled	Y ₁	Y ₂	Pooled
NDT-Sel-1	13.509 **	14.185* *	13.849 **	-0.101 **	-0.076 **	-0.087 **	-0.11	0.015	-0.05
NDT-Sel-2	10.859 **	10.870* *	10.864 **	-0.115 **	0.052**	-0.082 **	0.281 **	0.281 **	0.283 **
NDT-Sel-3	-0.791	0.037	-0.378	0.057 **	-0.009	0.025 **	-0.09	0.078 *	-0.01
NDT-4	8.330 **	8.357**	8.343**	-0.019 *	0.034**	-0.027 **	0.09	0.104**	0.096 *
NDT-Sel-5	-10.141 **	11.885* *	- 11.011**	-0.030 **	0.036**	-0.033 **	0.09	0.138**	0.114 **
NDT-Sel-6	-8.962 **	- 8.663**	- 8.813**	0.070 **	0.034**	0.052 **	-0.346 **	-0.246**	-0.295 **
NDT-7	-8.970 **	- 9.429**	-9.200 **	0.080 **	0.041**	0.062 **	-0.293 **	-0.263**	-0.277 **
NDT-Sel-8	-0.508	1.035	0.263	0.063 **	0.073**	0.069 **	-0.07	-0.065	-0.07
NDT-Sel-9	11.197 **	11.761* **	11.479 **	-0.047 **	-0.007	-0.028 **	0.11	0.112 **	0.111 **
NDT-Sel-10	-10.892 **	- 11.781* **	-11.337 **	0.077 **	0.084**	0.079 **	0.144 *	0.161**	0.153 **
T6	-3.633 *	- 4.487**	-4.060 *	-0.035 **	-0.020 **	-0.029 **	0.194 **	-0.315**	-0.06
SE (g _i) lines	1.69	0.09	1.57	0	0.56	0	0.05	1.61	0.03
SE(g _i - g _j)	2.39	0.13	2.23	0.01	0.79	0	0.08	2.29	0.05
Testers									
Arka vikash	-0.31	0.002	-0.153	-0.016 **	- 0.029**	-0.023**	-0.125 **	- 0.095**	-0.111 **
Kashi chayan	1.11	1.488	1.299	0.029**	0.040**	0.035 **	0.05	0.001	0.03
Kashi aman	-0.801	-1.49	-1.146	-0.013 **	-0.011 **	-0.012 **	0.075 *	0.094 **	0.086 **
SE (g _i)	0.05	0.05	0.04	0	0.29	0	0.03	0.84	0.02
SE (g _i - g _j)	1.25	0.06	1.16	0	0.41	0	0.04	1.20	0.03

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Traits	Polar diameter			Equitorial diameter			Total fruit yield per plant		
	Y ₁	Y ₂	Pooled	Y ₁	Y ₂	Pooled	Y ₁	Y ₂	Pooled
NDT-Sel-1	-0.22	-0.302**	-0.258**	0.305**	0.243*	0.275**	0.282**	0.226**	0.253**
NDT-Sel-2	0.699**	0.526**	0.613**	0.652**	0.606**	0.629**	0.187**	0.133	0.161**
NDT-Sel-3	-0.401**	-0.519**	-0.460**	-0.06	-0.07	-0.07	-0.199**	-	-0.194**
NDT-4	0.926**	0.665**	0.797**	0.03	0.01	0.02	0.399**	0.426**	0.412**
NDT-Sel-5	0.412**	0.330**	0.371**	-0.05	0.02	-0.01	-0.391**	-	-0.412**
NDT-Sel-6	-0.367**	-0.426**	-0.397**	-0.561**	-0.572**	-0.566**	-0.317**	-	-0.291**
NDT-7	-0.05	-0.12	-0.09	0.07	0.08	0.08	-0.239**	-0.183**	-0.210**
NDT-Sel-8	-0.20	0.05	-0.08	0.559**	0.524**	0.540**	-0.10	-0.111	-0.11
NDT-Sel-9	-0.04	-0.08	-0.06	-0.11	-0.12	-0.12	0.229**	0.296**	0.264**
NDT-Sel-10	-0.444**	-0.18	-0.310**	-0.721**	-0.719**	-0.720**	-0.255**	-	-0.276**
T6	-0.317**	0.05	-0.13	-0.13	0.01	-0.06	0.405**	0.399**	0.400**
SE (g _i) lines	0.11	0.11	0.08	0.08	0.09	0.06	0.06	0.02	0.05
SE(g _i - g _j)	0.16	0.16	0.11	0.12	0.14	0.09	0.09	0.04	0.08
Testers									
Arka vikash	0.09	0.02	0.05	-0.03	-0.02	-0.03	0.02	-0.007	0.01
Kashi chayan	0.05	0.01	0.03	0.00	0.02	0.01	0.225**	0.209**	0.217**
Kashi aman	-0.135*	-0.03	-0.08	0.03	0.01	0.02	-0.244**	-	-0.222**
SE (g _i)	0.04	0.05	0.03	0.04	0.05	0.03	0.03	0.01	0.02
SE (g _i -g _j)	0.08	0.08	0.06	0.06	0.07	0.05	0.05	0.02	0.04

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Traits	Marketable fruit yield per plant			Total soluble solid			Titrable acidity		
	Y ₁	Y ₂	Pooled	Y ₁	Y ₂	Pooled	Y ₁	Y ₂	Pooled
NDT-Sel-1	0.02	0.066*	0.043 *	0.10	0.098	0.10	-0.031 **	-0.017 **	-0.022 **
NDT-Sel-2	0.288 **	0.205**	0.247 **	0.11	0.231 **	0.170 **	-0.070 **	-0.052 **	-0.062 **
NDT-Sel-3	-0.249 **	-	-0.209 **	-0.765 **	-0.790 ***	-0.775 **	0.01	0.002	0.01
NDT-4	-0.069 *	-0.066 *	-0.069 **	0.225 **	0.182 *	0.203 **	-0.067 **	-	-0.068 **
NDT-Sel-5	-0.136 **	-	-0.125 **	0.06	0.018	0.04	-0.018 *	-0.021 **	-0.020 **
NDT-Sel-6	0.03	0.043	0.04	-0.04	-0.075	-0.06	0.01	-0.002	0.00
NDT-7	-0.179 **	-	-0.175 **	0.298 **	0.256 **	0.276 **	0.119 **	0.116 **	0.117 **
NDT-Sel-8	0.01	-0.073 *	-0.03	0.07	0.032	0.05	-0.025 **	-0.023 **	-0.022 **
NDT-Sel-9	-0.136 **	-	-0.120 **	0.04	0.113	0.08	0.01	0.004	0.01
NDT-Sel-10	0.381 **	0.355**	0.368 **	-0.182 *	-0.218 *	-0.200 **	-0.065 **	-0.057 **	-0.062 **
T6	0.03	0.029	0.03	0.08	0.152	0.116 *	0.129 **	0.119 **	0.122 **
SE (g _i) lines	0.02	0.06	0.01	0.08	0.08	0.05	0.01	0.01	0.00
SE(g _i - g _j)	0.04	0.09	0.03	0.12	0.12	0.08	0.01	0.01	0.01
Testers									
Arka vikash	-0.02	-0.034 *	-0.027 *	-0.158 **	-	-0.176 **	-0.019 **	-0.016 **	-0.017 **
Kashi chayan	-0.01	0.029	0.01	0.08	0.194**	0.118 **	0.01	0.002	0.002
Kashi aman	0.03	0.005	0.01	0.08	0.038	0.058 *	0.014 **	0.014 **	0.014 **
SE (g _i)	0.01	0.03	0.01	0.04	0.04	0.02	0.00	0.00	0.00
SE (g _i -g _j)	0.02	0.05	0.01	0.06	0.06	0.04	0.01	0.00	0.00

Conti...

Traits	Ascorbic acid content			Total Sugar			Lycopene		
	Y ₁	Y ₂	Pooled	Y ₁	Y ₂	Pooled	Y ₁	Y ₂	Pooled
NDT-Sel-1	-1.337**	-1.429**	-1.382**	-0.01	0.039	0.02	-0.08	-0.059	-0.07
NDT-Sel-2	-0.943**	-1.446**	-1.195**	0.01	0.086	0.05	0.04	0.013	0.03
NDT-Sel-3	-1.473**	-0.696*	-1.083**	-0.135**	-0.067	-0.102**	0.00	-0.033	-0.02
NDT-4	-0.830**	-0.137	-0.481**	0.099**	0.195**	0.146**	-0.09	0.165**	0.04
NDT-Sel-5	1.763**	0.222	0.991**	0.159**	0.229**	0.194**	0.304**	0.640**	0.471**
NDT-Sel-6	0.510**	0.194	0.353*	-0.045*	0.033	-0.01	-0.01	-0.091	-0.05
NDT-7	0.540**	0.128	0.332*	0.02	-0.159**	-0.070*	-0.123*	-0.268**	-0.195**
NDT-Sel-8	1.167**	1.748**	1.457**	-0.02	-0.018	-0.02	-0.193**	-0.249**	-0.220**
NDT-Sel-9	1.160**	1.534**	1.348**	-0.04	-0.327**	-0.182**	0.06	-0.139*	-0.04
NDT-Sel-10	0.550**	-0.048	0.25	0.02	-0.151**	-0.066*	-0.04	-0.083	-0.06
T6	-1.107**	-0.072	-0.589**	-0.055*	0.139*	0.04	0.123*	0.103	0.114*
SE (g _i) lines	0.15	0.27	0.14	0.02	0.05	0.03	0.05	0.05	0.04
SE(g _i - g _j)	0.22	0.40	0.20	0.03	0.07	0.04	0.08	0.08	0.06
Testers									
Arka vikash	-0.780**	-0.610**	-0.696**	0.00	0.04	0.02	-0.144**	-0.096**	-0.120**
Kashi chayan	-0.14	-0.15	-0.14	0.052**	0.012	0.032*	0.336**	0.376**	0.355**
Kashi aman	0.916**	0.760**	0.838**	-0.055**	-0.052	-0.054**	-0.192**	-0.280**	-0.236**
SE (g _i)	0.08	0.14	0.07	0.01	0.02	0.01	0.02	0.03	0.02
SE (g _i -g _j)	0.12	0.21	0.10	0.02	0.04	0.02	0.04	0.04	0.03

Table-3. Estimates of specific combining ability (sca) effects of crosses for eighteen characters in tomato over two years (Y_1 , Y_2) and Pooled

Crosses	Days to 50 % flowering			Days to first fruit harvest			Plant height		
	Y_1	Y_2	Pooled	Y_1	Y_2	Pooled	Y_1	Y_2	Pooled
L1×T1	1.92	1.768	2.015 **	-0.39	-3.535 **	-0.170	-5.031 *	-3.85	-4.440 *
L1 × T2	-1.41	-1.505	-1.258 **	0.49	1.253	-0.977	4.1	-1.52	-2.83
L1 × T3	-0.51	-0.263	-0.758 **	-0.09	2.283 *	3.269	0.93	5.36	1.78
L2 × T1	-1.64	-1.343	-1.318 **	-2.51	-2.202 *	-0.190	-3.91	-1.75	2.63
L2 × T2	1.36	1.384	2.409 **	5.040 **	4.253 **	-0.983	3.95	-2.41	-1.27
L2 × T3	0.27	-0.040	-1.091 **	-2.54	-2.051 *	-0.480	-0.04	4.15	0.57
L3 × T1	-0.75	-0.455	0.015	0.94	-0.091	-0.010	2.4	1.17	1.29
L3 × T2	0.59	0.273	0.742 **	-0.85	1.364	0.703	-2.76	-1.47	1.29
L3 × T3	0.16	0.182	-0.758 **	-0.09	-1.273	1.172	0.36	0.30	-0.92
L4 × T1	-0.75	-0.343	-0.652 **	0.16	2.020 *	-0.150	3.73	1.54	-0.01
L4 × T2	0.59	0.051	1.076 **	-0.29	-2.525 **	3.445 **	-2.55	0.51	1.91
L4 × T3	0.16	0.293	-0.424 **	0.13	0.505	0.191	-1.18	-2.05	1.29
L5 × T1	0.92	0.434	0.848 **	0.50	-0.424	0.150	0.25	-2.78	0.77
L5 × T2	1.25	1.162	0.576 **	0.71	0.697	-1.046	-2.13	0.23	-2.11
L5 × T3	-2.172 *	-1.596	-1.424 **	-1.20	-0.273	0.762	1.89	2.56	-1.02
L6 × T1	0.70	0.545	0.348 *	-3.838 *	-3.202 **	-0.150	0.37	0.76	-0.95
L6 × T2	2.03	1.939	2.076 **	-3.29	-2.414 *	-0.644	-1.38	-0.67	-1.02
L6 × T3	-2.727 *	-2.485 *	-2.424 **	7.131 **	5.616 **	-0.339	1.01	-0.09	-0.36
L7 × T1	-0.75	-0.455	-0.985 **	0.50	0.465	0.333 **	1.03	1.56	1.95
L7 × T2	0.59	0.273	0.742 **	-0.63	-1.081	-1.398 *	-1.74	1.03	5.051 **
L7 × T3	0.16	0.182	0.242	0.13	0.616	-1.842	0.71	-2.58	-2.26
L8 × T1	-1.30	-1.343	-1.152 **	0.61	0.576	0.281 *	-0.97	3.54	-1.33
L8 × T2	0.36	0.384	0.076	-3.18	-3.636 **	0.105	-1.04	4.94	3.15
L8 × T3	0.94	0.960	1.076 **	2.58	3.061 **	-0.069	2.01	-8.479 **	2.06
L9 × T1	-0.64	-1.010	-1.985 **	2.94	2.465 **	0.120	-4	2.16	0.33
L9 × T2	0.03	0.384	0.742 **	0.82	0.919	0.333	8.361 **	1.74	-1.61
L9 × T3	0.61	0.626	1.242 **	-3.758 *	-3.384 **	0.029	-4.36	-3.9	2.22
L10 × T1	-0.30	0.212	-0.318 *	-0.17	2.576 **	-0.020	1.88	-1.91	0.46
L10 × T2	-2.970 **	-2.727 **	-3.591 **	-0.29	-0.303	-2.073 **	-3.13	-1.39	-0.94
L10 × T3	3.273 **	2.515	3.909 **	0.47	-2.273 *	-3.215	1.25	3.31	-3.24
L11 × T1	2.586 *	1.990	3.182 **	1.27	1.354	-0.200	4.26	-0.44	-4.127 *
L11 × T2	-2.414 *	-1.616	-3.591 **	1.49	1.475	2.536 **	-1.67	-0.99	2.28
L11 × T3	-0.17	-0.374	0.409 *	-2.76	-2.828 **	0.521	-2.59	1.43	-0.58
SE (S_{ij})	2.9906	2.8430	0.4384	4.6706	2.6069	2.2424	6.97	7.61	5.35
SE ($S_{ij} - S_{kl}$)	1.4953	1.4215	0.2192	2.3353	1.3034	1.1212	3.48	3.8	2.67
CD 5%	2.1123	2.008	0.3097	3.299	1.8412	1.5838	4.92	5.38	3.79

Conti....

Crosses	No. of primary branches/plant			Number of fruits per cluster			No. of fruit per plant		
	Y ₁	Y ₂	Pooled	Y ₁	Y ₂	Pooled	Y ₁	Y ₂	Pooled
L1×T1	-0.25	-0.332	-0.290 *	-0.12	-0.219	-0.17	-0.39	-1.57	-0.98
L1 × T2	0.763 **	0.700 **	-0.657 **	-0.03	0.162	-0.19	0.45	3.371 ***	-0.98
L1 × T3	-0.513 **	-0.368	-0.20	0.15	0.057	-0.01	-0.06	-1.80	0.7
L2 × T1	-0.846 **	-0.474 *	0.13	-0.2	-0.184	-0.15	-0.98	-0.99	3.445 **
L2 × T2	0.00	-0.272	0.22	0.07	0.057	0.15	1.43	3.032 **	-1.05
L2 × T3	0.850 **	0.746 **	-0.22	0.13	0.128	-0.15	-0.45	-2.045 *	-0.64
L3 × T1	-0.26	-0.145	-0.03	-0.01	-0.010	0.333 **	0.79	0.61	-1.398 *
L3 × T2	-0.21	-0.350	0.25	-0.03	-0.032	0.281 *	-1.01	-1.36	0.11
L3 × T3	0.467 **	0.495 *	0.11	0.04	0.042	0.12	0.21	0.74	0.33
L4 × T1	0.18	0.087	-0.04	-0.14	-0.165	-0.02	2.629 **	4.259**	-2.073 **
L4 × T2	-0.1	-0.147	0.743 **	0.04	-0.008	-0.2	-3.692**	-4.625**	2.536 **
L4 × T3	-0.08	0.060	0.732 **	0.09	0.173	0.07	1.06	0.37	1.909 **
L5 × T1	0.23	0.199	-0.14	0.19	0.112	0.06	-1.03	-1.06	2.234 **
L5 × T2	-0.22	-0.165	-0.28	0.23	0.223	-0.03	1.01	0.34	-1.18
L5 × T3	-0.01	-0.034	-0.12	-0.414 *	-0.336 *	0.01	0.02	0.73	-4.159 **
L6 × T1	-0.18	-0.275	-0.19	-0.15	-0.148	0.222 *	-0.69	-0.60	0.67
L6 × T2	-0.384 *	-0.393	-0.388 **	-0.06	0.000	-0.03	1.807 *	1.06	1.436 *
L6 × T3	0.560 **	0.668 **	1.131 **	0.2	0.148	-0.650 **	-1.12	-0.47	1.745 *
L7 × T1	-0.03	-0.033	-0.02	0.3	0.362 *	0.12	-1.21	-1.58	-1.29
L7 × T2	1.253 **	1.006 **	0.2	-0.692 **	-0.610**	0.15	1.46	2.032 *	1.519 *
L7 × T3	-1.223 **	-0.973**	-0.12	0.389 *	0.248	-0.03	-0.25	-0.45	0.72
L8 × T1	0.2	0.294	-0.805 **	0.23	0.338 *	0.1	0.26	-0.05	-3.608 **
L8 × T2	-0.11	0.073	-0.441 **	0.23	0.009	0.1	-1.15	-1.43	-0.93
L8 × T3	-0.09	-0.366	0.799 **	-0.457 **	-0.347 *	0.13	0.89	1.48	-1.25
L9 × T1	0.17	0.045	0.482 **	0.12	0.126	0.04	0.72	-0.05	0.48
L9 × T2	0.22	0.184	-0.01	0.16	0.143	0.13	1.38	1.66	0.71
L9 × T3	-0.393 *	-0.228	-0.03	-0.28	-0.269	-0.372 **	-2.097 *	-1.61	0.37
L10 × T1	-0.05	-0.016	0.612 **	-0.02	-0.013	0.18	-2.109 *	-2.037 *	-0.79
L10 × T2	-0.15	-0.094	-1.099 **	-0.03	-0.036	0.317 **	1.06	0.38	-0.35
L10 × T3	0.2	0.110	-0.23	0.05	0.049	-0.404 **	1.05	1.66	1.18
L11 × T1	0.837 **	0.650 **	-0.310 *	-0.21	-0.199	-0.275 *	2.008 *	3.064 **	-1.852 **
L11 × T2	-1.070 **	-0.541 *	0.15	0.11	0.092	0.05	-2.753 **	-4.460**	1.353 *
L11 × T3	0.23	-0.110	0.06	0.11	0.107	0.11	0.75	1.40	1.07
SE (S_{ij})	0.45	0.66	0.4	0.44	0.03	0.31	2.47	0.16	1.88
SE (S_{ij}-S_{kr})	2.89	2.89	2.89	0.22	0.01	0.15	1.23	0.08	0.94
CD 5%	0.32	0.47	0.29	0.32	0.03	0.22	1.75	0.12	1.33

Conti....

Crosses	Average fruit weight			Pericarp thickness			No of locules per fruit		
	Y ₁	Y ₂	Pooled	Y ₁	Y ₂	Pooled	Y ₁	Y ₂	Pooled
LIXT1	3.13	3.41	3.27	-0.02	0.01	-0.01	-0.06	0.102	0.02
L1 × T2	0.43	1.54	-0.48	0.03	0.040 **	-0.035 **	-0.03	-0.084	0.01
L1 × T3	-3.56	-4.95	1.17	-0.01	-0.049 ***	-0.02	0.09	-0.017	-0.04
L2 × T1	-0.85	-0.11	0.19	-0.033 *	-0.038 **	0.024 *	0.03	-0.004	0.01
L2 × T2	2.09	1.11	0.76	0.038 *	0.080**	0.02	-0.05	0.000	0.272 **
L2 × T3	-1.25	-1.00	-0.34	-0.01	-0.042 **	-0.035 **	0.03	0.004	-0.136 *
L3 × T1	0.02	2.33	-1.84	0.01	-0.034 **	-0.01	-0.14	0.058	0.00
L3 × T2	-0.84	-3.08	-0.07	-0.01	-0.02	0.00	-0.256 *	-0.244**	-0.09
L3 × T3	0.82	0.75	0.03	0.00	0.051 ***	0.02	0.398 **	0.186 **	-0.01
L4 × T1	0.06	0.32	-3.22	-0.01	0.054 ***	0.02	0.03	0.003	-0.234 **
L4 × T2	-2.05	1.04	0.52	0.036 *	0.02	0.023 *	-0.246 *	-0.173 **	0.191 **
L4 × T3	1.99	-1.36	0.98	-0.031 *	-0.077 ***	0.033 **	0.218 *	0.170 **	-0.06
L5 × T1	-0.52	2.04	1.6	0.01	0.026 *	0.061 **	0.318 **	0.228**	-0.03
L5 × T2	-0.76	-4.76	-1.96	-0.02	-0.033 *	-0.01	0.434 **	0.413**	-0.252 **
L5 × T3	1.28	2.72	-0.51	0.01	0.01	0.029 **	-0.752 ***	-0.641**	-0.206 **
L6 × T1	-0.31	-0.37	-2.76	-0.02	-0.054 ***	-0.028 **	-0.218 *	-0.057	0.423 **
L6 × T2	-1.02	-0.74	-0.88	0.01	0.02	0.01	0.17	0.120 *	0.142 *
L6 × T3	1.32	1.11	0.42	0.01	0.034 **	0.01	0.05	-0.063	0.06
L7 × T1	-0.99	-2.69	-1.32	0.01	-0.031 *	-0.01	0.03	-0.021	-0.167 *
L7 × T2	-0.46	1.30	-0.27	0.00	0.01	-0.039 **	0.01	0.104	-0.07
L7 × T3	1.45	1.39	0.21	-0.01	0.02	-0.021 *	-0.04	-0.083	0.1
L8 × T1	0.71	-0.84	4.48	0.00	-0.01	-0.032 **	-0.08	-0.102	0.05
L8 × T2	-1.66	-0.99	-4.25	-0.01	-0.01	-0.027 *	-0.19	-0.141 *	0.03
L8 × T3	0.95	1.83	-1.12	0.01	0.02	-0.026 *	0.272 *	0.243**	0.01
L9 × T1	0.06	-0.01	0.78	0.01	0.027 *	0.027 **	0	-0.025	0.294 **
L9 × T2	0.14	-0.67	0.32	-0.03	-0.052**	-0.054 **	-0.09	-0.041	0.193 **
L9 × T3	-0.2	0.67	2.00	0.02	0.03	0.01	0.09	0.066	-0.694 **
L10 × T1	-1.74	-4.69	1.21	0.01	0.032 *	0.021 *	-0.248 *	-0.224**	-0.01
L10 × T2	-0.38	0.79	1.42	-0.01	-0.037 **	0.00	0.09	0.110	-0.06
L10 × T3	2.12	3.90	1.39	0.00	0.00	0.01	0.16	0.114	0.256 **
L11 × T1	0.43	0.62	0.24	0.03	0.02	0.021 *	0.342 **	0.042	0.08
L11 × T2	4.5	4.45	3.01	-0.032 *	-0.029 *	0.00	0.17	-0.064	0.137 *
L11 × T3	-4.93	-5.07	-5.00	0.01	0.01	0.01	-0.508 **	0.023	-0.242 **
SE (S_{ij})	8.3	0.45	7.72	0.04	2.76	0.02	0.29	7.93	0.18
SE (S_{ij}-S_{kl})	4.15	0.22	3.86	3.48	3.8	2.67	0.14	3.96	0.09
CD 5%	5.87	0.32	5.46	0.03	1.95	0.02	0.21	5.6	0.13

Conti....

Crosses	Polar diameter			Equatorial diameter			Total fruit yield per plant		
	Y ₁	Y ₂	Pooled	Y ₁	Y ₂	Pooled	Y ₁	Y ₂	Pooled
L1XT1	-0.29	-0.19	-0.24	-0.11	-0.14	-0.12	0.05	-0.006	0.02
L1 × T2	0.18	0.24	-0.045	-0.27	-0.25	0.20	0.00	0.188	0.03
L1 × T3	0.11	-0.05	0.018	0.377 *	0.383 *	0.236 *	-0.05	-0.182	0.06
L2 × T1	0.01	-0.09	-0.218	0.21	0.20	-0.06	-0.05	0.097	0.241 *
L2 × T2	-0.09	0.03	0.097	0.334 *	0.29	-0.03	0.09	-0.059	-0.10
L2 × T3	0.08	0.06	-0.162	-0.539 **	-0.490 **	-0.17	-0.04	-0.039	-0.07
L3 × T1	0.05	-0.01	-0.037	0.24	0.23	-0.09	0.05	0.073	-0.17
L3 × T2	0.11	0.20	0.331 *	0.07	0.05	0.20	-0.08	-0.120	-0.01
L3 × T3	-0.15	-0.19	-0.018	-0.313 *	-0.28	0.02	0.03	0.047	0.03
L4 × T1	-0.09	-0.35	-0.058	-0.05	-0.06	-0.18	0.21	0.271 *	-0.251 *
L4 × T2	-0.14	0.06	0.332 *	-0.01	-0.03	-0.02	-0.328 **	-0.246	0.217 *
L4 × T3	0.23	0.29	0.21	0.06	0.09	-0.259 *	0.12	-0.025	0.09
L5 × T1	0.07	0.13	-0.025	-0.11	0.06	0.314 **	-0.15	-0.040	0.02
L5 × T2	-0.01	0.03	0.149	0.06	-0.04	0.06	0.07	-0.080	-0.10
L5 × T3	-0.06	-0.16	-0.041	0.04	-0.02	-0.02	0.08	0.120	-0.287 **
L6 × T1	-0.20	-0.13	0.008	-0.17	-0.17	0.01	-0.07	-0.074	0.00
L6 × T2	0.00	0.04	0.019	-0.472 **	-0.470 **	-0.471 **	0.10	0.093	0.10
L6 × T3	0.20	0.09	-0.023	0.644 **	0.637 **	0.09	-0.03	-0.020	0.16
L7 × T1	-0.07	0.00	-0.282 *	-0.07	-0.10	0.333 **	-0.12	-0.210	-0.08
L7 × T2	-0.04	-0.01	-0.178	0.06	0.11	0.11	0.09	0.223	0.16
L7 × T3	0.11	0.01	0.169	0.00	0.00	-0.237 *	0.04	-0.013	0.07
L8 × T1	-0.02	0.676 **	-0.005	0.21	0.19	0.06	0.05	-0.059	-0.12
L8 × T2	-0.14	-0.42	0.031	0.348 *	0.32	0.383 **	-0.09	-0.072	-0.12
L8 × T3	0.16	-0.26	0.069	-0.556 **	-0.518 **	-0.517 **	0.05	0.131	-0.04
L9 × T1	-0.04	0.00	-0.167	0.03	0.02	-0.297 *	0.06	-0.006	0.04
L9 × T2	-0.23	-0.13	0.259	0.12	0.10	0.08	0.17	0.144	0.05
L9 × T3	0.27	0.13	-0.105	-0.15	-0.12	0.01	-0.232 *	-0.139	0.10
L10 × T1	0.07	-0.19	0.143	-0.18	-0.19	0.640 **	-0.21	-0.294 *	-0.02
L10 × T2	0.32	0.02	0.061	-0.23	-0.24	0.00	0.06	0.087	0.01
L10 × T3	-0.39	0.17	-0.048	0.414 **	0.428 *	-0.535 **	0.15	0.207	0.09
L11 × T1	0.504 *	0.15	0.196	0.00	-0.05	-0.13	0.19	0.247 *	-0.18
L11 × T2	0.05	-0.06	-0.111	-0.02	0.15	0.418 **	-0.08	-0.159	0.18
L11 × T3	-0.555 **	-0.10	-0.327 *	0.02	-0.11	-0.04	-0.11	-0.089	-0.10
SE (S _{ij})	0.55	0.55	0.39	0.42	0.47	0.32	0.32	0.14	0.27
SE (S _{ij} -S _{kl})	0.27	0.27	0.19	0.21	0.23	0.16	0.16	0.70	0.13
CD 5%	0.39	0.39	0.28	0.30	0.33	0.23	0.23	0.10	0.20

Crosses	Marketable fruit yield/plant			Total soluble solid			Titrable acidity		
	Y ₁	Y ₂	Pooled	Y ₁	Y ₂	Pooled	Y ₁	Y ₂	Pooled
L1XT1	-0.08	-0.164 **	-0.119 **	0.15	0.15	0.15	-0.01	-0.023 *	-0.02
L1 × T2	0.01	0.156 **	-0.02	0.09	0.08	-0.02	-0.042 **	-0.02	0.00
L1 × T3	0.08	0.01	0.02	-0.24	-0.23	-2.017 **	0.050 **	0.044 **	0.01
L2 × T1	-0.07	0.03	0.097 **	0.04	-0.09	0.321 **	0.00	0.00	0.01
L2 × T2	0.00	0.06	0.00	-0.18	0.07	0.11	0.00	0.00	-0.01
L2 × T3	0.07	-0.09	-0.01	0.14	0.02	0.484 **	0.00	0.00	0.01
L3 × T1	0.00	0.04	0.01	-2.055 **	-1.975 **	0.268 **	0.00	0.01	0.01
L3 × T2	-0.01	-0.01	-0.01	0.966 **	0.869 **	0.216 *	0.00	0.00	-0.022 **
L3 × T3	0.01	-0.03	-0.01	1.089 **	1.106 **	-0.03	0.00	0.00	0.00
L4 × T1	0.110 *	0.09	0.077 *	0.305 *	0.336 *	0.307 **	0.02	0.01	0.00
L4 × T2	-0.05	-0.09	-0.03	-0.19	-0.27	0.212 *	-0.01	0.00	0.01
L4 × T3	-0.07	0.00	0.079 *	-0.11	-0.07	0.09	-0.02	-0.01	-0.033 **
L5 × T1	-0.01	0.01	0.03	0.09	0.13	-0.06	-0.02	0.00	0.00
L5 × T2	-0.02	-0.08	-0.01	0.04	-0.03	0.919 **	0.01	-0.01	0.00
L5 × T3	0.03	0.07	-0.06	-0.14	-0.10	-0.230 *	0.02	0.01	0.00
L6 × T1	0.01	-0.03	-0.05	0.468 **	0.497 **	0.00	0.01	0.01	0.00
L6 × T2	-0.04	-0.04	-0.04	-0.24	-0.312 *	-0.277 **	-0.02	-0.02	-0.020 *
L6 × T3	0.03	0.06	0.00	-0.23	-0.19	-0.11	0.01	0.01	0.02
L7 × T1	0.01	0.00	-0.05	0.25	0.29	0.03	0.01	0.01	0.031 **
L7 × T2	0.01	0.00	-0.01	-0.07	-0.14	-0.07	0.02	0.01	0.016 *
L7 × T3	-0.02	-0.01	0.141 **	-0.19	-0.14	-0.223 *	-0.030 *	-0.02	0.00
L8 × T1	-0.07	0.06	-0.04	0.20	0.23	-0.08	-0.025 *	-0.02	0.00
L8 × T2	0.01	-0.115 *	0.04	0.07	-0.01	-0.236 *	0.032 *	0.031 **	0.047 **
L8 × T3	0.06	0.06	-0.01	-0.27	-0.22	0.08	-0.01	-0.01	0.00
L9 × T1	-0.01	0.00	-0.01	0.01	-0.06	1.098 **	0.00	0.00	0.00
L9 × T2	-0.02	0.01	-0.03	-0.14	0.01	-0.09	0.02	0.02	-0.01
L9 × T3	0.03	0.00	0.05	0.13	0.06	-0.11	-0.01	-0.02	0.01
L10 × T1	0.170 **	-0.01	0.05	0.292 *	0.326 *	-0.207 *	-0.01	0.01	0.01
L10 × T2	0.125 *	0.154 **	-0.01	-0.19	-0.26	-0.16	0.00	0.00	-0.025 **
L10 × T3	-0.295 **	-0.141 **	0.06	-0.11	-0.07	-0.248 *	0.00	0.00	-0.01
L11 × T1	-0.05	-0.01	0.02	0.25	0.17	0.09	0.01	0.00	-0.01
L11 × T2	-0.02	-0.06	-0.218 **	-0.16	0.00	-0.08	0.00	0.00	0.00
L11 × T3	0.07	0.06	0.07	-0.10	-0.17	-0.13	-0.01	0.00	-0.01
SE (S _{ij})	0.14	0.32	0.09	0.40	0.40	0.26	0.03	0.03	0.02
SE (S _{ij} -S _{kl})	0.07	0.16	0.40	0.20	0.20	0.13	0.01	0.01	0.01
CD 5%	0.10	0.23	0.07	0.29	0.29	0.19	0.02	0.02	0.02

Conti...

Crosses	Ascorbic acid content (mg/100 g)			Total sugar (mg/100 g)			Lycopene		
	Y ₁	Y ₂	Pooled	Y ₁	Y ₂	Pooled	Y ₁	Y ₂	Pooled
L1XT1	-0.43	0.19	-0.12	-0.03	-0.05	-0.04	-0.03	-0.326 **	-0.178 *
L1 × T2	0.26	0.85	0.28	-0.075 *	-0.06	-0.01	-0.01	0.05	0.01
L1 × T3	0.17	-1.040 *	-0.04	0.102 **	0.11	-0.05	0.04	0.278 **	-0.01
L2 × T1	0.14	0.41	0.29	0.00	-0.02	-0.09	0.00	0.01	0.14
L2 × T2	-0.03	0.54	-0.07	0.05	0.10	-0.06	-0.10	0.283 **	0.12
L2 × T3	-0.11	-0.94	0.46	-0.05	-0.08	-0.04	0.10	-0.295 **	-0.14
L3 × T1	0.05	-0.13	-0.531 *	-0.03	-0.08	0.08	0.01	-0.04	0.01
L3 × T2	-0.47	-0.28	-0.48	0.02	0.06	0.02	-0.01	-0.06	0.09
L3 × T3	0.42	0.42	0.30	0.01	0.01	0.107 *	-0.01	0.11	-0.195 *
L4 × T1	0.43	0.15	-0.27	-0.05	-0.13	0.00	-0.05	0.338 **	-0.14
L4 × T2	-0.21	0.10	0.18	0.01	0.09	0.10	0.237 *	0.248 *	0.298 **
L4 × T3	-0.22	-0.25	0.554 *	0.05	0.04	-0.07	-0.19	-0.586 **	0.02
L5 × T1	-0.27	0.14	0.25	-0.04	-0.07	0.07	0.11	0.13	0.09
L5 × T2	0.18	-1.528 **	-0.38	-0.02	0.02	0.04	-0.276 **	-0.434 **	-0.03
L5 × T3	0.09	1.389 **	-0.05	0.07	0.06	0.05	0.16	0.309 **	0.245 **
L6 × T1	0.13	0.78	-0.676 **	-0.02	-0.07	0.00	0.00	-0.284 **	-0.359 **
L6 × T2	0.50	0.77	0.632 *	0.07	0.14	0.107 *	0.00	-0.01	0.00
L6 × T3	-0.633 *	-1.544 **	1.066 **	-0.05	-0.08	-0.125 *	-0.01	0.290 **	-0.02
L7 × T1	0.10	-1.166 *	-0.25	0.06	0.09	0.02	-0.15	0.16	-0.191 *
L7 × T2	0.50	1.633 **	-1.186 **	0.02	-0.271 **	-0.07	0.09	-0.13	0.10
L7 × T3	-0.603 *	-0.47	0.07	-0.075 *	0.18	0.05	0.06	-0.03	0.202 *
L8 × T1	-0.52	-0.44	-0.04	0.05	-0.02	-0.07	0.02	0.15	-0.05
L8 × T2	-0.17	-0.33	-0.43	-0.04	0.08	0.107 *	-0.14	-0.245 *	0.158 *
L8 × T3	0.691 *	0.76	-0.528 *	-0.01	-0.06	-0.06	0.12	0.09	-0.10
L9 × T1	0.46	0.15	0.42	0.05	0.16	0.01	-0.06	-0.326 **	0.05
L9 × T2	-1.161 **	-1.214 *	-0.24	-0.03	-0.11	0.05	0.14	0.06	-0.384 **
L9 × T3	0.697 *	1.066 *	0.743 **	-0.02	-0.05	0.06	-0.08	0.264 *	0.236 **
L10 × T1	0.09	-0.63	-1.086 **	0.00	0.00	-0.06	-0.15	-0.12	0.14
L10 × T2	0.47	-0.33	-0.535 *	0.05	0.04	0.05	0.08	0.329 **	0.01
L10 × T3	-0.563 *	0.96	0.727 **	-0.05	-0.03	-0.03	0.07	-0.208 *	0.10
L11 × T1	-0.19	0.55	0.883 **	0.02	0.186 *	-0.04	0.288 **	0.309 **	0.09
L11 × T2	0.14	-0.21	0.20	-0.06	-0.09	-0.04	-0.02	-0.09	-0.07
L11 × T3	0.05	-0.35	-0.15	0.04	-0.10	-0.03	-0.274 **	-0.218 *	-0.243 **
SE (S _{ij})	0.77	1.36	0.69	0.10	0.25	0.14	0.26	0.28	0.22
SE (S _{ij} -S _{kl})	0.38	0.68	0.34	0.05	0.12	0.07	0.13	0.14	0.11
CD 5%	0.55	0.97	0.49	0.07	0.18	0.11	0.19	0.20	0.16

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