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Research Paper

Studies on combining ability of promising lines for yield and its components in tomato

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ABSTRACT

Thirty two F_1 hybrids developed as a result of line x tester design involving 8 lines and 4 testers were evaluated in RCBD with three replications during 2005-2006 for tomato for yield and its components. A measure of general and components of genetic variance would be of great value in choice of parents and for effective crosses for crop improvement. Generally, general combining ability is largely associated with additive gene action. While the specific combining ability was the result of dominance epistasis and genotype environment interactions (Spagoe and Tatum, 1942). The analysis of variance for all the characters studied indicated significant differences among hybrids. The line x tester analysis for combining ability revealed the role of non-additive gene action for all the traits under consideration, except for number of primary branches indicating preponderance of non-additive components of genetic variance.

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Key words : Tomato, Hybrids, Genetic variance, Crop improvement

INTRODUCTION

Tomato is the world's largest grown vegetable crop known as protective food both because of its nutritive value and also because of its wide spread production. Tomato is rich source of minerals, Vitamins and organic acid, essential amino acids and dietary fibers. The estimated area and production of tomato crop are about 3.50 lakh ha and 53 lakh tons(www.indiaagronet.com). The average productivity of tomato in our country is merely 158q/ha while its productivity in USA is 588q/ha,in Greece 498q/ha,in Italy 466q/ha and 465q/ha in Spain (www.indiaagronet.com). So, commercial exploitation of hybrid vigour in tomato in India has received great importance on an account of several advantages of hybrids over pure line varieties such as increased yield, high resistance to biotic and abiotic stress. Keeping there facts under consideration the present investigation was designed on combining ability studies of promising lines for yield and its components in tomato.

MATERIALS AND METHODS

The experiment was carried out at the Department of Horticulture, University of Agricultural Sciences, Gandhi Krishi Vignana Kendra, Bangalore during 2005-2006. The experimental material consisted of F_1 population of 32 crosses, developed by crossing 8 lines and 4 testers. The F_1 population of 32 crosses were grown along with standard check Arka Abhijith and their parents (Table 1). Spacing was maintained at 50 cm between the plants and 100 cm between the rows. Data were recorded on plant height (cm), number of primary branches, number of secondary branches, days to 50 per cent flowering, days to first fruit maturity, number of fruits clusters per plant, average fruit weight, total yield per plant (kg), TSS (^{O}Brix), pericarp thickness (mm), number of locules per fruit and fruit firmness. Statistical analysis was carried out as per Singh and Choudhary (1977). Combining ability analysis following line x tester techniques was followed.

Table 1: Details of lines, testers and commercial check used for linex tester analysis

Sr. No.	Details	Devloped by
Lines		
L_1	L-15 (Megha)	UAS Dharwad
L_2	Vybhav	UAS Bangalore
L_3	Hissar Anmol	HAU-Hissar.IARI,New Delhi
L_4	PKM-1	TNAU-Coimbatore
L_5	Pusa Ruby	IARI,New Delhi
L_6	Arka vikas	IIHR, Bangalore
L_7	Arka Meghali	IIHR, Bangalore
L_8	Arka Sourabh	IIHR, Bangalore
Testers		
T_1	BWR-1 (Arka Abha)	IIHR, Bangalore
T_2	BWR-1 (Arka Alok)	IIHR, Bangalore
T_3	Sankranthi	UAS Bangalore
T_4	Nandi	UAS Bangalore
Commercial Check	Arka Abhijith.	IIHR, Bangalore

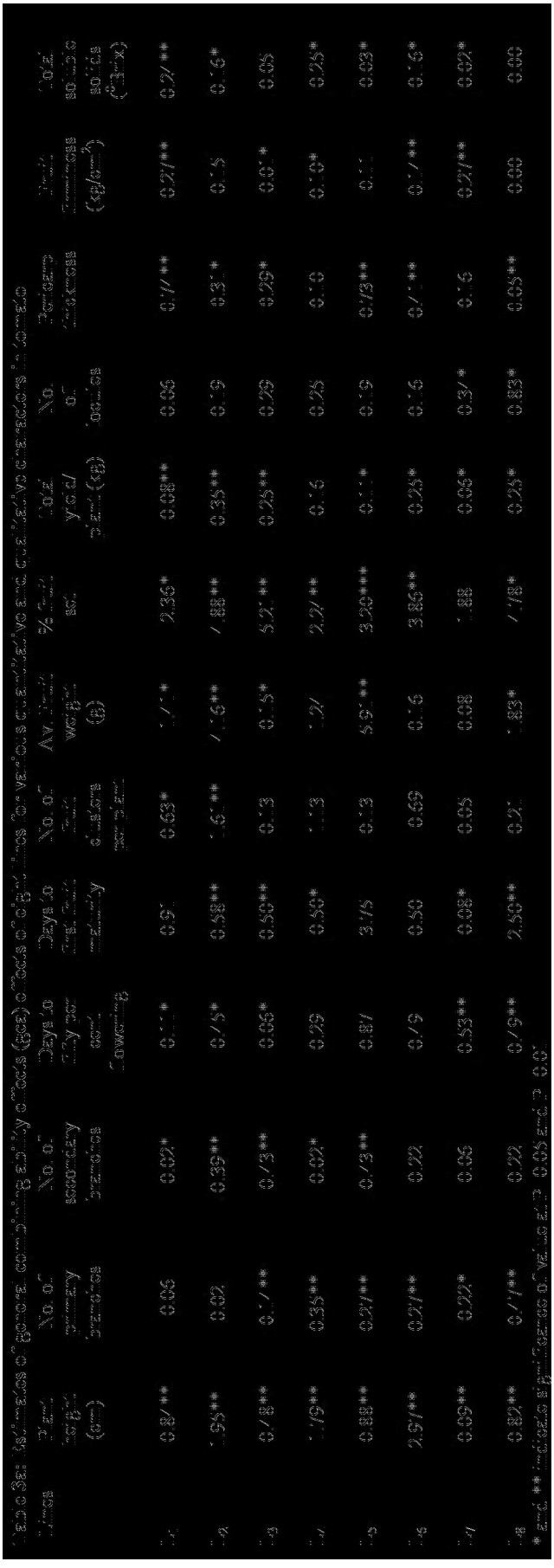
RESULTS AND DISCUSSION

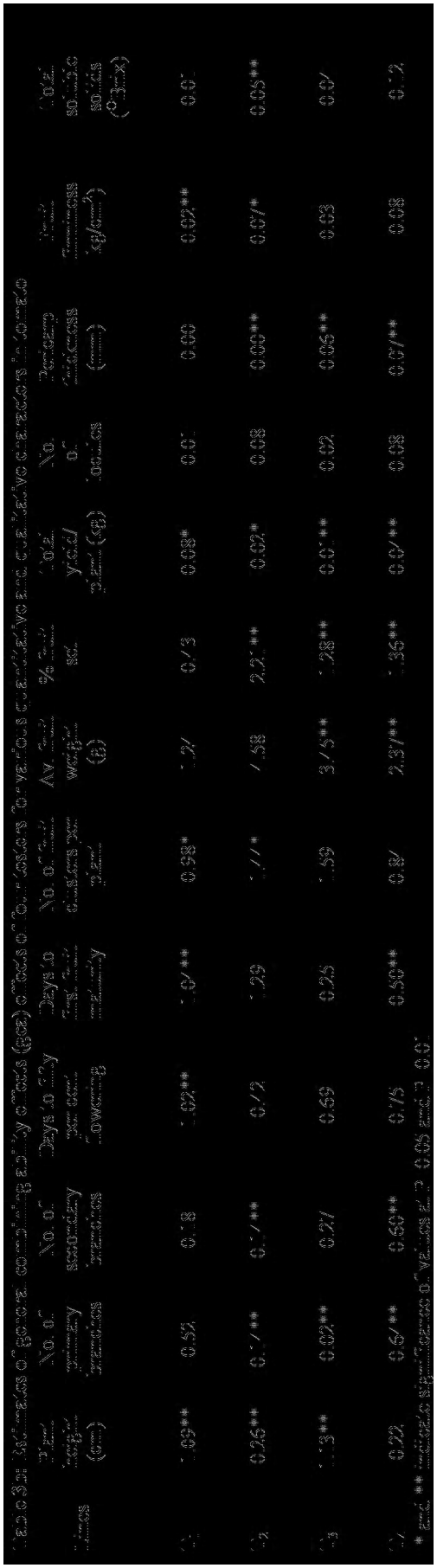
The results obtained from the present investigation have been duscussed below:

The variance due to general and specific combining ability and GCA to SCA ratio for various characters are presented in Table 2, GCA to SCA ratio was higher than unity for plant height, number of secondary branches, days

Table 2 : Variance due to general combining ability (GCA) and specific combining ability effects (SCA) for various quantitative and qualitative characters in tomato

Characters	GCA	SCA	GCA : SCA
Plant height (cm)	0.051	4.982	1: 83.99
Number of primary branches	0.016	-0.063	1: -4.90
Number of secondary branches	0.001	0.168	1: 28.98
Days to fifty per cent flowering	0.002	1.750	1: 312.01
Days to first fruit maturity	0.195	1.666	1: 8.41
Number of fruits / clusters	0.101	0.952	1: 8.92
Per cent fruit set	0.948	2.394	1: 2.53
Average fruit weight (g)	0.579	22.761	1: 39.38
Total yield/plant (kg)	0.017	0.021	1: 4.89
Number of locules	0.001	0.256	1: 82.13
Pericarp thickness (mm)	0.003	0.248	1: 37.33
Fruit firmness (kg/cm^2)	0.001	0.075	1 : 215.96
Total soluble solids (^{O}Brix)	0.005	0.039	1 : 51.85





to fifty per cent flowering, days to first fruit maturity, number of fruits per cluster, per cent fruit set, average fruit weight, total yield per plant, pericarp thickness, fruit firmness, number of locules and total soluble solids GCA to SCA ratio was lower than unity for number of primary branches.

The variance due to general and specific combining ability and GCA to SCA ratio for various characters are presented in Table (2) GCA to SCA ratio was higher than unity for Plant height, Number of Secondary branches, Days to fifty percent flowering ,Days to first fruit maturity, Average fruit weight, Total yield per plant, Pericarp thickness, Fruit firmness, Number of locules and Total Soluble Solids. GCA to SCA ratio was lower than units for Number of primary branches. Similar Results were recorded by Peter and Rai (1980), Singh and Singh and Singh (1980), Maya *et al.* (1986) and Dharmatti (1995).

General Combining ability of eight lines and four tester for various quantitative and qualitative characters were studied in tomato and are presented in Table 3a and 3b.

Table 3a: Among the lines 6 had maximum GCA value for plant height, Line L_6 recorded the significant GCA Value. For No of primary branches, line L_4 had maximum GCA value the significant GCA value. Line L_2 had maximum GCA value for No.of secondary brasnches. Negative GCA effects for Days to fifty per cent flowering which is desirable was expressed by five lines, line L_7 had the hightest significant negative GCA value. For days to First fruit marurity line L_8 showed highest significant negative GCA effect .For number of fruit clusters per plant positive GCA values was found for four lines of which two were significant and maximum was recorded for the line L_8. For average fruit weight line L_2 has highest GCA value. Line L_3 had the maximum GCA value for percent fruit set. For total yield/plant L_2 had the maximum GCA effect. Line L_8 had significant value for number of locules .Positive GCA effect for pericarp thicknes was recorded highest in line L_5. For fruit firmness significant and positive GCA effect was positive and maximum in line L_2. Line L1 had the maximum significant positive GCA value for T.S.S. Similar Results were recorded by peter and Rai (1980).

The analysis of variance for all the characters studied indicated significant differences among hybrids. The line x tester analysis for combining ability revealed the role of non-additive gene action for all the traits under consideration, except for number of primary branches indicating preponderance of non-additive components of genetic variance (Table 4).

The majority of crosses, high SCA effect was due to high x high and high x low of low x high cross combination

Table 4 : Estimates of specific combining effects (sca) of crosses for various quantitative and qualitative characters in tomato

Crosses	Plant height (cm)	No. of primary branches	No. of secondary branches	Days to fifty per cent flowering	Days to first fruit maturity	No. of fruiting clusters per plant	Av. Fruit weight (g)	% fruit set	Total yield/ plant (kg)	No. of locules	Pericarp thickness (mm)	Fruit firmness kg/cm²	Total soluble solids (°Brix)
L1 x T1	0.18**	0.22	0.52**	1.64**	0.04	0.59**	3.50	0.20	0.00	0.14*	0.41	0.12	0.10*
L1 x T2	0.17	0.27	0.18	0.94**	0.70	0.13*	4.83	0.70	0.09	0.58	0.51	0.12	0.22
L1 x T3	1.24**	0.22**	0.06	0.64**	0.75	0.82	10.13**	0.11	0.14**	0.17	0.40*	0.26	0.00
L1 x T4	1.25	0.27**	0.27	0.08	1.50**	0.09*	1.79	1.22	0.04	0.61**	0.52*	0.51**	0.12*
L2 x T1	3.98	0.14	0.39	0.36**	0.87	1.32	2.41**	2.4	0.15**	0.31**	0.18*	0.02**	0.18**
L2 x T2	2.29	0.14**	0.89**	0.93	0.12*	1.11	3.41**	2.04*	0.07**	0.30**	0.28*	0.04	0.14
L2 x T3	2.51	0.02	0.31	0.37**	1.08**	1.26**	3.61	1.63*	0.21**	0.45**	0.45	0.11*	0.01**
L2 x T4	4.20	0.02**	0.18	0.97**	0.33	1.17**	2.21	0.10*	0.11	0.15	0.01	0.10	0.05
L3 x T1	0.25	0.02**	0.89	1.17	0.12	1.09**	0.23	0.54*	0.05*	0.20*	0.12	0.02*	0.22
L3 x T2	1.94	0.31**	1.06**	0.17	0.20**	0.69	3.43**	0.04*	0.17**	0.22	0.29	0.11*	0.11
L3 x T3	0.18	0.18	0.18**	1.39**	0.50	0.65	3.33	0.70	0.08	0.18**	0.50**	0.55	0.27**
L3 x T4	1.87**	0.14	0.35	1.33**	0.41**	0.26*	0.14**	0.19*	0.14	0.16	0.18	0.42*	0.06*
L4 x T1	1.30	0.18*	0.52**	2.05	0.20**	0.42*	0.49**	0.29*	0.06	0.66	0.16	0.17*	0.50
L4 x T2	2.05**	0.18	0.14**	0.68**	0.87**	0.36	0.16	0.13*	0.01	0.07	0.29	0.20*	0.10*
L4 x T3	1.79	0.02	0.72	0.97*	0.50	0.34*	1.86	0.61	0.16*	0.06	0.96	0.10	0.22*
L4 x T4	1.04*	0.02*	0.06*	1.91*	0.58	0.40	1.54*	0.56	0.09	0.80*	0.50*	0.28	0.17*
L5 x T1	1.12**	0.77**	0.10**	0.80	1.79	0.57	5.00	0.19**	0.05**	0.36	0.66**	0.08**	0.05*
L5 x T2	1.64	0.39**	0360	2.07	1.79	0.03	4.00	0.29**	0.01**	0.33**	0.50**	0.15**	0.16*
L5 x T3	2.00	0.43	0.18**	0.59	0.58	1.65	0.40	0.13**	0.18	0.94	0.96	0.24**	0.00
L5 x T4	2.53**	0.72	0.31**	0.13	3.00	0.26**	9.70	0.61	0.12	0.92	0.20	0.47	0.22
L6 x T1	0.58**	0.22	0.22	0.85	0.87**	0.74	8.08	0.56	0.08	0.01	0.11	0.06**	0.02*
L6 x T2	2.38**	0.06	0.06	0.38*	.79	0.19	3.74	2.11	0.03	0.08	0.21**	0.02**	0.03
L6 x T3	0.15	0.10	0.18**	1.75**	1.16**	1.17**	7.28**	2.04**	0.04**	0.47	0.13**	0.05*	0.00
L6 x T4	3.13	0.27*	0.02	0.85	1.25	0.24	4.54**	0.63*	0.08**	0.58**	0.22	0.1	0.13*
L7 x T1	2.90	0.06	0.39	0.38**	0.04	0.34**	2.00*	1.10*	0.09	0.46**	0.03*	0.27	0.16*
L7 x T2	0.52	0.43	0.77	1.75	0.37	0.21**	1.66**	3.21*	0.11	0.36**	0.16**	0.24	0.07*
L7 x T3	0.36	0.06	0.68**	1.82	0.41	0.59	2.63	3.61	0.06*	0.22	0.63	0.38**	0.03
L7 x T4	2.74	0.43	0.47*	2.42**	0.83**	1.15	1.04	0.70	0.14**	0.57	0.43**	0.12**	0.20
L8 x T1	1.04	0.31	0.77**	1.15*	1.79	0.17**	0.25**	1.66	0.20	0.05	0.05	0.01**	0.19
L8 x T2	3.14	0.02	0.60	1.05	1.12	2.05**	0.08	1.08**	0.01	0.02	0.05	0.09	0.16
L8 x T3	2.55**	0.47	0.14	0.78	0.50**	0.24	4.04	1.33**	0.02	0.25**	0.05	0.13**	0.47
L8 x T4	1.63*	0.14	0.02	0.39*	2.41	1.99	3.87	1.02**	0.04	0.18	0.16	0.05	0.11**
S.E.	1.63	0.63	0.60	1.07	0.61	0.67	0.97	2.45	1.16	0.06	0.20	0.11	0.15

indicating the importance of additive x additive and additive x dominance or dominance x additive type of interaction, respectively. Among the crosses Vybhav x Arka Alok showed significant SCA effects for average fruit weight (g), per cent fruit set and total yield per plant (kg) (Table 4)

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