

Combining Ability Analysis for Grain Yield and Its Attributes in Maize (*Zea mays* L.)

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Abstract

Combining ability analysis was carried out for grain yield and some of its attributes in systematic set of crosses following line \times tester mating design, involving ten lines and four testers. The resulting 40 crosses were evaluated in randomized block design. The variance due to general combining ability (GCA) and specific combining ability (SCA) showed that gene action was predominantly additive for all the characters. The line L_{10} (Pant 7421 + $S_3 - 93 - 1$) was best general combiner among female parents for grain yield, ears per plot, ear length, ear height, plant height, days to tassel, days to silk and days to maturity. However, the line L_6 (Pant 7421 + $S_3 - 107 - 1$) also a good general combined for grain yield and its component traits followed by L_1 ($M_9 + S_4 - 2 - 1$) and L_2 ($M_9 + S_4 - 36 - 1$). Among the testers, T_4 (Jogia local + $S_3 - 1 - 39$) was best general combiner for grain yield and its components followed by T_1 (Jogia local + $S_3 - 10 - 2$). The SCA effects of the crosses were found to be significant only for grain yield and ears per plot. The hybrids / crosses, L_{10} (Pant 7421 + $S_3 - 93 - 1$) \times T_4 (Jogia local + $S_3 - 72 - 1 - 39$), L_2 ($M_9 + S_4 - 36 - 1$) \times T_2 (Jogia local + $S_3 - 4 - 2 - 8$) L_6 (Pant 7421 + $S_3 - 107 - 1$) \times T_3 (Jogia local + $S_3 - 12 - 1 - 15$) and L_5 ($M_9 + S_4 - 37 - 2$) \times T_2 (Jogia local + $S_3 - 10 - 2 - 13$) were found to be good specific combiners for grain yield. These hybrids may be used as single cross commercial hybrids after verifying the results on a larger area.

Key words : *Zea mays*, Combining ability, GCA, SCA, Grain yield.

The aim of a plant breeder is to identify parents that combine well and produce productive progenies. The success in identifying such parents mainly depends on the gene action that control the trait under improvement. Utilization and exploitation of yield and yield contributing characters require a clear cut understanding of their mode of inheritance. The breeding method, efficiency of selection and the final success are dependent on germplasm chosen. Combining ability studies provide the information on the genetic mechanism controlling quantitative traits and enable us to select suitable parents for further improvement or use in hybrid combinations for commercial purpose. The present study was carried out to estimate the combining ability of fourteen parental lines for ten quantitative traits.

Methods

The experimental material consisted of 40 crosses of maize produced by crossing 10 lines (female parents) with four testers (pollen parents). The pedi-

gree of the female parents, designated as L_1 to L_{10} were L_1 ($M_9 + S_4 - 2 - 1$), L_2 ($M_9 + S_4 - 36 - 1$), L_3 ($M_9 + S_4 - 37 - 1$), L_4 ($M_9 + S_4 - 37 - 2$), L_5 ($M_9 + S_4 - 37 - 3$), L_6 (Pant 7421 + $S_3 - 22 - 1$), L_7 (Pant 7421 + $S_3 - 16 - 1$), L_8 (Pant 7421 + $S_3 - 22 - 1$), L_9 (Pant 7421 + $S_3 - 76 - 1$) and L_{10} (Pant 7421 + $S_3 - 93 - 1$). T_1 (Jogia local + $S_3 - 4 - 2 - 8$), T_2 (Jogia local + $S_3 - 10 - 2 - 13$), T_3 (Jogia local + $S_3 - 12 - 1 - 15$) and T_4 (Jogia local + $S_3 - 72 - 1 - 39$), respectively were used as testers. The 40 crosses along with 14 parents and an standard check (CM 300 \times CM 400) were evaluated at experimental farm, T. C. A., Dholi, Rajendra Agricultural University, Pusa, Bihar, during the *kharif*, of 1994 in a randomized block design with three replications. Each entry was provided a two-row plot of 5.0 m length. Inter row and inter plant distances were kept at 75 cm and 25 cm respectively. Observations were recorded for 10 quantitative characters viz. plant height (cm), ear height (cm), days to tassel (50%), days to silk (50%), days to maturity (50%), ear diameter (cm), ear length (cm), number of ears per plot, 1,000-kernels weight (g) and grain yield (kg/ha). Combining ability analysis

Table 1. Analysis of variance for combining ability for different traits in maize. *, **—Significant at 5% and 1% levels, respectively.

Source of variation	df	Plant height (cm)	Ear height (cm)	Days to 50% tassel	Days to 50% silk	Days to maturity
Treatments	53	732.99**	247.87**	4.07	4.69*	3.61
Parents	13	583.56**	145.86	2.65	3.21	3.45
Crosses	39	402.86**	140.30	4.33	5.19*	3.62
Parents vs crosses	1	15550.50**	5769.43**	12.43	4.74	5.26
Lines	9	794.01**	318.44**	7.33*	10.44**	5.68
Testers	3	562.80	46.51	2.32	1.88	1.11
Line × tester	27	254.71	91.34	3.55	3.80	3.21
Error	106	258.01	103.92	3.60	3.68	3.83
GCA : SCA		1 : 5.32	1 : 3.99	1 : 2.71	1 : 3.24	1 : 2.11

Table 1. Continued.

Source of variation	df	Ear length (cm)	Ear diameter (cm)	Ears/plot	1000-grain weight (g)	Grain yield (kg/ha)
Treatments	53	11.09**	0.42**	72.38**	0.0056*	0.87**
Parents	13	11.00**	0.50**	84.67**	0.0046	0.70**
Crosses	39	8.78**	0.16**	50.50**	0.0047**	0.51**
Parents vs crosses	1	102.32**	9.51**	765.97**	0.0535**	17.11**
Lines	9	19.72	0.39**	98.89**	0.0063	0.82**
Testers	3	17.30**	0.30*	100.82*	0.0058	1.85**
Line × tester	27	4.19	0.007	28.79*	0.0040	0.26*
Error	106	4.00	0.05	15.42	0.0034	0.18
GCA : SCA		1 : 8.83	1 : 9.85	1 : 6.93	1 : 3.02	1 : 10.26

was carried out following the method as suggested by Kempthorne (1).

Results and Discussion

The analysis of variance for combining ability revealed that the genotypes were significantly related to all the characters except days to 50% tassel and days to maturity (Table 1). The treatment effects were further partitioned into different components i.e. crosses, parents and parents vs crosses. The crosses showed significant differences for all the characters except ear height, days to 50% tassels and days to maturity. The parents were found to be highly significant for the characters plant height, ear length, ear diameter, ears per plot and grain yield. The parents vs crosses also showed significant differences for all the characters except i.e. days to tassel, days to silk and days to maturity. Mean squares due to lines were significant for all the characters except days to maturity, ear length and 1,000-grain weight.

However, mean squares due to testers were significant for ear length, ear diameter, ears per plot and grain yield. The line × tester effect was significant for ears per plot and gain yield only. The variance due to GCA and SCA indicated that predominance of additive gene action was deserved for all the character. Previous studies have also shown that in relatively selected material, additive gene action was more important than non-additive gene action (2—6). The general combining ability effects of female (lines) and male parents (testes) are presented in Table 2. The GCA variance of females (lines) were found to differ significantly for plant height, ear height, days to tassel, days to silk, ear length, ear diameter, ears per plot and grain yield. However, GCA of males (testers) was found to be significant for ear length, ear diameter, ears per plot and grain yield only. High significant GCA effect for grain yield was also reported earlier (7—9). The line L_{10} (Pant 7421 + S_3 -93-1), L_6 (Pant 7421 + S_3 -107-1), L_1 (Mg + S_4 -2-1) and L_2 (Mg + S_3 -36-1) were good general combiners

Table 2. Estimates of the general combining ability effects of the parents. *, ** - Significant at 5% and 1% levels, respectively.

Parents and testers	Plant height (cm)	Ear height (cm)	Days to 50% tassel	Days to 50% silk	Days to maturity	Ear length (cm)	Ear diameter (cm)	Ears/Plot	1000-grain weight (g)	Grain yield (kg/ha)
Female Parents										
L ₁ (Mg+S ₄ -2-1)	8.00**	7.44**	0.19	0.36	0.35	1.73	0.33	-4.03**	-0.0007	0.18
L ₂ (Mg+S ₄ -36-1)	-0.33	-2.35*	-0.80	-0.80	-0.60	0.21	0.06	2.63*	0.0044	0.11
L ₃ (Mg+S ₄ -37-1)	-16.16**	-9.01**	0.44	0.36	-0.01	-1.23	0.22	-2.20*	0.0003	-0.12
L ₄ (Mg+S ₄ -37-2)	7.79**	4.52**	-1.05	-0.96	0.15	0.78	0.14	3.13**	-0.0014	0.04
L ₅ (Mg+S ₄ -37-3)	-0.12	0.15	0.44	0.36	0.06	-2.20*	-0.07	-2.95**	-0.0150	-0.27
L ₆ (Pant 7421+S ₃ -107-1)	6.12**	-2.14*	1.10	1.70	1.40	-0.55	0.33	3.63**	0.0481	0.32
L ₇ (Pant 7421+S ₃ -16-1)	3.62**	0.15	0.19	-0.38	-0.10	-0.68	0.13	-0.11	-0.0303	-0.29
L ₈ (Pant 7421+S ₃ -22-1)	-3.25**	0.35	0.35	0.36	-0.18	1.04	0.001	-0.36	0.0270	-0.02
L ₉ (Pant 7421+S ₃ -76-1)	-10.95**	-5.51**	0.44	0.53	0.73	-0.66	-0.36	-2.53*	-0.0151	-0.34
L ₁₀ (Pant 7421+S ₃ -93-1)	5.29**	6.40**	-1.30	-1.55	-1.10	1.56	-0.02	2.80*	-0.0172	0.40
Testers										
T ₁ (Jogia local+S ₃ -4-2-8)	-2.66**	-0.14	-0.15	-0.10	-0.01	-0.68	0.10	-0.06	-0.0046	0.004
T ₂ (Jogia local+S ₃ -10-2-13)	-0.16	-1.30	-0.19	-0.20	-0.01	-0.56	-0.11	-2.50*	-0.0143	-0.15
T ₃ (Jogia local+S ₃ -12-1-15)	-3.33**	1.69	0.40	0.36	0.25	0.90	-0.05	0.76	-0.0006	-0.20
T ₄ (Jogia local+S ₃ -72-1-39)	6.16**	-0.24	-0.05	-0.06	-0.21	0.34	0.06	1.80*	0.0189	0.34
SE (gi)	4.63	2.94	0.54	0.55	0.56	0.57	0.06	1.13	0.0168	0.12
SE (gi-gi)	2.93	1.86	0.34	0.35	0.35	0.36	0.04	0.71	0.0106	0.07

for most of the yield and yield attributing traits. The line L₁₀ (Pant 7421+S₃-93-1) was the best general combiner for grain yield while L₂ (Mg+S₃-36-1) for days to tassel, days to silk, days to maturity ears per plant, 1,000-grain weight and grain yield. However, line L₁ (Mg+S₃-2-2) showed good GCA effect for plant height, ear diameter and grain yield followed by L₆ (Pant 7421+S₃-107-1) for plant height, ear diameter, ears per plot, 1,000-grain weight and grain yield. The line L₄ (Mg+S₃-37-2) was good general combiner for all the seven traits studied except days to maturity, 1,000-grain weight and grain yield. These findings are in accordance with the earlier results (2, 6, 9—11). Among the testers, T₄ (Jogia local + S₃-72-1-39) and T₁ (Jogia local + S₃-4-2-8) were found to be good general combiners for grain yield and its at-

tributing traits. The tester T₄ (Jogia local + S₃-72-1-39) was found to be good general combiner for grain yield, 1,000-grain weight, ears per plot, ear diameter, ear length, days to maturity. However, tester T₁ (Jogia

Table 3. Rank correlation coefficient between mean performance and GCA effects of lines for grain yield and component characters. **, Significant at 1% levels.

Characters	Value of rank correlation coefficient
Grain yield (kg/ha)	0.8829**
Ear length (cm)	0.9637**
Ear diameter (cm)	0.7334**
Ears per plot	0.9394**
1,000-kernel weight (g)	0.9758**

Table 4. Mean performance and SCA effects of crosses. *, ** —Significant at 5 and 1% levels, respectively.

	Plant height (cm)		Ear height (cm)		Days to 50% tassel		Days to 50% silk		Days to maturity	
	Mean	SCA	Mean	SCA	Mean	SCA	Mean	SCA	Mean	SCA
L ₁ × T ₁	190.83	16.00**	96.67	3.47**	57.67	0.04	61.00	0.26	91.33	0.68
	181.67	4.33**	91.67	-0.35	57.00	-0.22	61.67	10.3	91.67	1.01
	170.83	-3.33**	100.83	5.80**	58.33	0.50	60.67	-0.53	89.67	-1.25
	166.60	-17.00**	84.17	-8.92**	56.67	-0.69	60.00	-0.76	90.00	-0.43
L ₂ × T ₁	160.83	-5.66**	81.67	-1.73	55.33	-0.92	58.33	-1.23	89.33	-1.06
	173.33	4.33**	86.67	4.43**	55.33	-0.89	59.00	-0.46	90.00	-0.40
	165.00	-0.83	81.67	-3.56**	56.67	-0.15	59.67	-0.36	91.00	0.33
	177.50	2.16**	84.17	0.86	58.33	1.97	61.67	2.06*	91.33	1.13
L ₃ × T ₁	150.83	0.16	76.67	-0.06	58.00	0.49	61.67	0.93	92.33	1.33
	150.00	3.16**	76.67	1.10	56.67	-0.80	59.33	1.30	90.33	-0.65
	148.00	-1.66	76.67	-1.90	58.33	0.25	61.33	0.13	90.33	-0.91
	164.17	4.66**	77.50	0.86	57.67	0.05	61.00	0.23	91.00	0.21
L ₄ × T ₁	175.83	1.20	88.33	-1.94	55.33	-0.67	57.33	-0.06	90.67	-0.48
	170.00	-7.12**	88.33	-0.77	56.67	0.69	59.33	0.03	90.67	-0.48
	176.67	2.70**	95.00	2.89**	55.67	-0.90	59.33	-0.53	92.00	0.58
	186.67	3.20**	90.00	-0.17	57.00	0.89	60.00	0.56	91.33	0.38
L ₅ × T ₁	159.33	-13.37**	93.33	-6.73**	55.67	-1.84	58.67	2.06*	90.00	-1.06
	181.67	12.45**	93.33	8.60**	58.33	0.85	61.67	1.03	91.33	0.26
	159.17	-6.87**	79.17	-8.56**	58.33	0.25	61.67	0.46	92.00	0.66
	183.33	7.79**	92.50	6.70**	58.33	0.72	61.33	0.56	91.00	0.13
L ₆ × T ₁	176.67	3.70**	78.33	8.05**	59.00	0.82	63.00	0.93	93.33	0.93
	173.33	-2.12**	78.33	-4.10**	58.00	-0.14	61.67	-0.30	93.00	0.60
	172.50	0.20	79.17	-6.17**	58.33	-0.40	62.67	0.13	91.00	-1.66
	180.00	-1.79	85.83	2.32*	58.00	-0.27	61.33	-0.76	92.33	0.13
L ₇ × T ₁	176.67	6.20**	88.33	-0.90	58.33	1.07	60.67	0.68	92.00	1.10
	167.12	3.79**	88.33	3.60*	57.67	0.44	60.67	0.78	91.00	0.10
	166.67	-3.12**	89.17	1.43**	58.00	0.17	60.00	-0.45	91.00	-0.16
	180.00	0.72	81.67	-4.13**	55.67	-1.69	59.00	-1.01	89.67	-1.03
L ₈ × T ₁	169.17	5.58**	84.17	3.05**	57.33	-0.91	60.33	-0.40	90.67	-0.15
	159.17	-6.91**	84.17	-0.77	55.67	-1.72	59.00	-1.63	90.00	-0.81
	150.83	-12.08**	83.33	-4.60**	59.33	1.34	2.33	1.13	91.00	-0.08
	185.83	13.41**	88.33	2.32*	58.00	0.47	61.67	0.90	91.67	1.05
L ₉ × T ₁	151.67	-4.20**	73.33	-1.06	58.67	1.15	62.00	1.10	92.00	0.26
	160.83	2.45*	73.33	-5.73**	57.33	-0.14	60.00	-0.80	91.33	-0.40
	160.83	5.62**	86.67	4.60**	57.67	-0.40	62.33	0.96	93.67	1.66
	160.68	-3.87**	82.33	2.20*	57.00	-0.60	59.67	-1.26	90.00	-1.53
L ₁₀ × T ₁	162.50	-9.62**	85.00	-2.15*	55.33	-0.42	58.67	-0.15	88.33	-1.56
	174.17	-0.45	85.00	-5.98**	57.67	1.94	60.33	1.61	90.67	0.76
	190.83	19.37**	104.17	10.18**	55.67	-0.65	58.33	-0.95	91.00	0.83
	171.67	-9.29**	90.00	-2.05*	55.00	-0.85	58.33	-0.51	89.67	-0.03
SE (ij)		9.27		5.88		1.09		1.10		1.13
				NS				NS		

Table 4. Continued.

	Ear length (cm)		Ear diameter (cm)		Ears/plot		1000-grain weight (g)		Grain yield (kg/ha)	
	Mean	SCA	Mean	SCA	Mean	SCA	Mean	SCA	Mean	SCA
L ₁ × T ₁	17.47	1.06	3.58	-0.06	15.33	-1.60	310	0.017	2760.00	0.20
	15.93	-0.58	3.52	0.09	14.33	-0.16	290	0.007	1719.99	0.42
	17.73	-0.25	3.45	-0.04	20.00	2.23*	280	-0.010	2199.99	-0.01
	17.20	-0.22	3.63	0.01	18.33	-0.46	300	-0.015	3253.32	-0.23
L ₂ × T ₁	16.27	1.38	3.59	-0.07	19.00	-4.60**	270	-0.028	2199.99	-0.13

Table 4. Continued.

	Ear length (cm)		Ear diameter (cm)		Ears/Plot		1000-grain weight (g)		Grain yield (kg/ha)	
	Mean	SCA	Mean	SCA	Mean	SCA	Mean	SCA	Mean	SCA
$\times T_2$	16.80	1.79	5.51	0.05	23.67	2.50*	300	0.011	2666.64	0.36
$\times T_3$	13.33	-2.94**	3.57	0.05	20.33	-4.10**	290	-0.009	1666.65	-0.33
$\times T_4$	15.67	-0.24	3.61	0.03	31.67	6.20**	350	0.026	2986.65	0.10
$L_3 \times T_1$	12.60	-0.83	3.68	0.04	19.00	0.23	270	-0.019	1866.66	0.14
$\times T_2$	12.53	-1.01	3.29	-0.13	15.00	-1.33	270	-0.010	1680.00	-0.13
$\times T_3$	15.87	0.84	3.28	-0.09	19.67	0.06	330	0.033	1786.65	-0.002
$\times T_4$	15.47	1.00	3.79	0.19	21.67	1.03	310	-0.003	2906.62	0.28
$L_4 \times T_1$	14.40	-1.04	3.76	0.007	28.67	4.56**	310	0.020	2466.66	0.12
$\times T_2$	15.73	0.16	3.52	-0.01	17.67	-4.00**	320	0.044	2453.31	0.26
$\times T_3$	17.80	0.75	3.55	-0.04	24.00	-0.93	230	0.063	2146.65	0.09
$\times T_4$	16.60	0.10	3.77	0.05	26.33	0.36	310	-0.001	2106.66	-0.49
$L_5 \times T_1$	11.93	0.53	3.77	-0.06	19.67	1.65	290	0.018	2280.00	0.30
$\times T_2$	13.00	0.41	3.54	0.21	15.33	-0.25	300	0.029	2106.66	0.33
$\times T_3$	15.00	0.94	3.23	-0.14	17.67	-1.18	230	-0.051	1186.65	-0.31
$\times T_4$	12.67	-0.82	3.49	-0.008	19.69	-0.21	300	0.004	1920.00	-0.31
$L_6 \times T_1$	14.00	-0.11	3.85	-0.10	21.33	-3.26**	290	-0.044	2599.98	-0.06
$\times T_2$	15.93	1.69	3.85	0.11	22.00	-0.16	360	0.031	2319.99	-0.10
$\times T_3$	14.40	-1.30	3.99	0.20	27.67	2.23*	340	-0.006	2853.33	0.34
$\times T_4$	14.87	-0.27	3.70	-0.21	27.67	1.20	380	0.018	2906.64	-0.17
$L_7 \times T_1$	14.07	0.08	3.49	0.01	25.67	4.81**	310	0.045	2178.32	0.24
$\times T_2$	14.07	-0.03	3.28	0.02	17.67	-0.75	220	-0.030	1719.99	0.05
$\times T_3$	15.73	0.15	3.45	0.11	20.67	-1.01	310	0.042	1599.99	0.02
$\times T_4$	14.80	-0.20	3.29	0.14	19.67	-3.05**	230	-0.057	1879.98	-0.32
$L_8 \times T_1$	15.80	0.08	3.59	-0.02	20.67	0.06	330	0.014	2040.00	-0.12
$\times T_2$	15.87	0.03	3.42	0.02	19.33	1.16	300	0.009	2066.64	0.05
$\times T_3$	17.47	0.15	3.37	-0.08	19.67	-1.76	330	0.006	1999.98	0.05
$\times T_4$	16.47	-0.27	3.67	0.08	23.00	0.53	330	-0.010	2679.99	0.01
$L_9 \times T_1$	14.73	0.73	3.53	0.28	18.00	-0.43	300	0.019	1653.33	-0.09
$\times T_2$	13.53	-0.58	2.60	-0.42	14.00	2.00*	200	-0.069	1519.98	-0.03
$\times T_3$	15.13	-0.45	3.07	-0.02	23.67	4.40**	310	0.030	1293.33	-0.15
$\times T_4$	15.33	0.30	3.38	0.16	18.33	-1.96	320	0.019	2599.98	0.27
$L_{10} \times T_1$	15.40	-0.83	3.58	-0.01	22.33	-1.43	230	-0.043	2373.33	-0.30
$\times T_2$	14.17	-1.38	3.13	0.05	26.33	5.00**	260	-0.004	2053.32	-0.39
$\times T_3$	19.93	22.10*	3.51	0.08	24.67	-0.06	310	0.028	2919.99	0.30
$\times T_4$	17.87	0.60	3.43	-0.12	22.00	-3.63**	320	0.019	3746.64	0.38
SE (ij)		1.15		0.138		2.26		0.0335		0.245

local +S₃-4-2-8) was found to be good general combiner for grain yield, ear diameter, days to maturity, days to silk, days to tassel and ear height. The lines and testers are of distant genetic origin. The correlation between GCA and mean performance for grain yield and four component characters of lines (Table 3) were significantly correlated. It suggests the influence of mean performance of GCA effects in the present investigation.

The mean performance and the SCA effects of crosses are presented in Table 4. The SCA estimates of the crosses were found to be significant only two characters, ears per plot and grain yield. The esti-

mates of specific combining ability (Table 5) show that cross/hybrid combination L₁₀ (Pant 7421 + S₃ - 93-1) × T₄ (Jogia local S₃ - 72-1-39) was the best for grain yield followed by L₂ (Mg + S₄ - 36-1) × T₂ (Jogia local + S₃ - 10-2-13), L₆ (Pant 7421 + S₃ - 107-1) × T₃ (Jogia local + S₃ - 12-1-15) and L₅ (Mg + S₄ - 37-2) × T₂ (Jogia local + S₃ - 10-2-13). The estimates of specific combining ability for ears per plot showed that L₂ (Mg + S₄ - 36-1) × T₄ (Jogia local + S₃ - 72-1-39), was the best combination followed by L₁₀ (Pant 7421 + S₃ - 93-1) × T₂ (Jogia local + S₃ - 4-2-8), T₇ (Pant 7421 + S₃ - 16-1) × T₁ (Jogia local + S₃ - 4-2-8) and L₉ (Pant 7421 + S₃ -

Table 5. Best specific combinations for grain yield and ears per plot along with GCA of the parents.

Cross / hybrids			SCA effects
Grain Yield			
L ₁₀ (0.40)	× T ₄ (0.34)	3746.64	0.38
L ₂ (0.11)	× T ₂ (-0.15)	2666.64	0.36
L ₆ (0.32)	× T ₃ (-0.20)	2853.33	0.34
L ₅ (-0.27)	× T ₂ (0.15)	2106.66	0.33
Ears Per Plot			
L ₂ (2.680)	× T ₄ (1.800)	31.67	6.200
L ₁₀ (2.800)	× T ₂ (2.5000)	26.33	5.00
L ₇ (-0.11)	× T ₁ (-0.06)	25.67	4.810
L ₄ (3.1333)	× T ₁ (-0.0667)	28.67	4.5667
L ₉ (-2.5333)	× T ₃ (0.7667)	23.67	4.4000
L ₄ (2.6333)	× T ₂ (-2.5000)	23.67	2.5000

76-1) × T₃ (Jogia local + S₃-12-1-15). An examination of the grain yield and ears per plot of the top crosses revealed that the hybrid combination cross L₂ (Mg+S₄-36-1) × T₂ (Jogia local + S₃-10-2-13) was common for grain yield and ears per plot, the parents were found to be possessing low GCA estimates for both characters.

The performance of crosses and presence of variability for this trait indicate the possibility of improving the grain yield and ears per plot simultaneously. Therefore, outstanding single crosses can be used as commercial hybrids or experimental data can be used to predict the performance of double cross or double top cross hybrids so as to identify superior combinations. The single-cross hybrids have theoretically higher yield potential and are more uniform than the double crosses. Improvement in management practices of inbred lines has permitted the production of single cross hybrids that are economically feasible for seed produces and farms. Presently about 85% of maize acreage in the United States of America is planted with single-cross hybrid seed (12). In the present investigation, the hybrids, L₁₀ (Pant 7421 + S₃-93-1) × T₄ (Jogia local + S₃-72-1-39), L₂ (Mg + S₄-36-1) × T₂ (Jogia local + S₃-4

-2-8), L₆ (Pant 7421 + S₃-107-1) × T₃ (Jogia local + S₃-12-1-15) and L₅ (Mg+S₄-37-2) × T₂ (Jogia local + S₃-10-2-13) were found to be good specific combiners for grain yield. These hybrids may be used as single cross commercial hybrids after verifying the results on a larger area.

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