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Studies on combining ability for yield and yield attributing traits in rice (*Oryza sativa* L.)

Dhavala Joshna, K Madhu Kumar, G Sreenivas, P Udayababu and D Manoj Kumar
Department of Genetic and Plant Breeding, ,Acharya N G Ranga Agricultural University, Agricultural College,Bapatla-522101, Andhra Pradesh, India

ABSTRACT

The present investigation was carried out at Agricultural Research Station, Ragolu, with a set of 20 experimental hybrids developed during *rabi* 2024-25 by crossing five lines with four testers in line x tester mating design. The twenty hybrids were evaluated in randomized complete block design with three replications along with the parents and three checks *viz*; MTU 1121, MTU 1061 and Aganni. Preponderance of non-additive gene action was found for majority of the yield components studied, namely,plant height, ear bearing tillers per plant, panicle length, filled grains per panicle, total grains per panicle, and kernel L/B ratio, desirable for exploitation of heterosis. The results also revealed that BPT 5204 and MTU 7029 were good combiners suggesting their potential utility in hybrid breeding programs. In the present study, the promising heterotic hybrids, viz; BPT 5204 x BPT 3082, MTU 1224 x BPT 3082, RGL 2537 x BPT 3082, BPT 5204 x MTU 1341 and RGL 2537 x KNM 1638 recorded large and favourable *sca* effects on grain yield per plant besides higher grain yield per plant compared to the checks, MTU 1121 and MTU 1061. Standard heterosis was also recorded more than 30 per cent with desirable *sca* effects for grain yield per plant. Therefore, these hybrids can be identified as promising heterotic combinations for further evaluation and commercial exploitation.

Keywords:*General combing ability, heterosis, rice and specific combining ability*

Rice, a versatile staple food for billions worldwide and the most widely consumed cereal grain, which plays a pivotal role in both global security and some traditions. It is a self pollinating cereal crop which belongs to the family Gramineae with chromosome number 2n=24. The slogan "Rice is Life" aptly describes the importance of rice in food and nutritional security (Cheng *et al*., 2021). In India, the cultivated area of paddy is 434.13 lakh hectares with a production and productivity of 1218.54 lakh tonnes and 1175 kg/ha respectively. The total area grown under paddy in Andhra Pradesh is 4.08 million hectares with production and productivity of 11.42 million tonnes and 2801 kg/ha respectively (Directorate of Economics and Statistics, 2020-21).

Parental genotypes must have the ability to combine and produce improved genotypic combinations. In plant breeding, selection of parents with high *gca* and hybrids with high *sca* is crucial for hybrid seed production in rice (Sprague and Tatum, 1942). Among the various estimates of genetic components, the combining ability analysis is one of the powerful tools to assess the combining ability effects and aids in selecting the desirable parents and crosses for the exploitation of heterosis. The concept of combining ability refers to the ability of a genotype to transmit superior performance to its crosses. Estimates of general combining ability helps in the selection of good general combiners for use in hybridization programs. Whereas, estimates of specific combining ability help in the selection of superior cross combinations in developing commercial hybrids. The combining ability analysis coupled with estimation of *gca* and *sca* effects of parents provided by line x tester analysis helps to determine the nature of gene action involved in the economically important traits.

MATERIAL AND METHODS

The present work was undertaken during *rabi* season, 2024-25 at Agricultural Research Station (ARS), Ragolu, Srikakulam district of Andhra

Pradesh. The experimental site is situated at 18°24'N latitude, 83°84'E longitude and 27 m above mean sea level, with red loamy soils located at 3 km away from Srikakulam town of Andhra Pradesh.The experimental material for the present study comprised of five lines namely MTU 1075, MTU 1224, RGL 2537, BPT 5204 and MTU 7029 and four testers namely MTU 1341, RGL 11414, BPT 3082 and KNM 1638 and their 20 hybrids crossed in line x tester fashion. All 20 hybrids along with parents and three checks, MTU 1121, MTU 1061 and Aganni were evaluated for yield and yield attributing traits to estimate combining ability Table 1.

Evaluation of the 20 hybrids along with their parents and checks was carried out in a randomized block design with two replications during *rabi*, 2024-2025 at Agricultural Research Station, Ragolu. Observations were recorded for yield and yield attributing traits like days to 50% flowering, plant height, ear bearing tillers per plant, panicle length, number of filled grains per panicle, grains per panicle, test weight, kernel length, kernel breadth, kernel L/B ratio and grain yield per plant, whereas gall midge incidence (%) was recorded per hill basis in ten randomly selected plants and their means were used for the statistical analysis. To analyse the collected data, we applied standard statistical methods. Statistical analysis for L x T mating design was carried out to estimate heterosis and combining abilities using Indostat (Panse and Sukhatme, 1967).

RESULTS AND DISCUSSION

General combining ability (GCA) reveals about additive gene effects and additive interactions, which are fixable, whereas the estimates of specific combining ability reveals about the non-additive gene effects which are non-fixable Table 5,6 and 7.

Analysis of Variance

Analysis of variance revealed significant differences among all the characters indicating existence of sufficient amount of variability in the material studied besides higher scope for selection of different quantitative characters for the genetic improvement of the crop Table 1. In general, the hybrids recorded higher average grain yield per plant (23.10 g), compared to the checks (17.73 g), lines (19.32 g) and the testers (20.20 g). The hybrid, BPT 5204 x BPT 3082 (27.90 g) has recorded significantly higher yield than all the three checks *viz*., MTU 1121 (19.90), MTU 1061 (20.10), Aganni (13.20) and were identified as the promising hybrids with potential commercial exploitation. The hybrids, in present study were observed to be early and relatively tall with more number of ear bearing tillers per plant and greater panicle length compared to the parents. Similar results have been reported by Kumar *et al*. (2024) and Modarresi *et al*. (2024).

A review of the results on the *gca*:*sca* variance ratio revealed preponderance of non- additive gene action for majority of the yield components studied, namely, plant height, ear bearing tillers per plant, panicle length, filled grains per panicle, total grains per panicle, and kernel L/B ratio, desirable for exploitation of heterosis. However, days to 50 per cent flowering, test weight, grain yield per plant, kernel length and kernel breadth had recorded pre-ponderant additive gene action (Patel *et al*., 2019 and Anandlekshmi *et al*., 2020).

General combining ability effects

The results on *gca* effects revealed significant and desirable effects for most of the traits such as days to 50 per cent flowering, plant height, filled grains per panicle, total grains per panicle, 1000 grain weight, grain yield per plant, kernel length, kernel breadth and kernel L/B ratio in both lines and testers Table 6. The results also revealed BPT 5204 to be a good combiner with high *per se* performance for panicle length, filled grains per panicle, totalgrains per panicle, test weight and kernel L/B ratio while, MTU 7029 was observed to be good combiner with high *per se* performance for filled grains per panicle and total grains per panicle, among the lines and among the testers, BPT 3082 was a good combiner and hence, may be utilized in hybrid breeding programmes for the development of improved heterotic hybrids(Parimala *et al.*, 2018; Saravanan *et al.*, 2018 and Krishna *et al*., 2024).

Specific combining ability effects

Significant and desirable specific combining ability effects were noticed in several hybrids for all the traits except for ear bearing tillers. The *sca* effects for grain yield per plant were significant and positive for three hybrids and ranged from -3.18 (RGL 2537 x MTU 1341) to 1.94 (MTU 1075 x MTU 1341). A perusal of the results on *per se* performance, heterosis and specific combining ability revealed the superiority

Table 1. Salient features of experimental material

S.No	Genotype	Source	Salient features
Lines			
1	MTU 1075	RARS, Maruteru	Medium duration, medium slender, non-lodging, tolerant to BPH and first CVRC released variety from RARS, Maruteru
2	MTU 1224	RARS, Maruteru	Medium duration, fine grain, early maturing, semi-dwarf, high yielding and excellent resistance to blast, bacterial leaf blight, brown spot and BPH
3	RGL 2537	ARS, Ragolu	Long duration, long slender, resistant to blast and tolerant to gallmidge
4	BPT 5204	ARS, Bapatla	Medium duration, medium slender, fine grain, non-lodging, non-shattering and best cooking quality
5	MTU 7029	RARS, Maruteru	Long duration, medium slender, low nitrogen responsive, tolerant to bacterial blight
Testers			
1	MTU 1341	RARS, Maruteru	Early duration, long slender grain, tolerant to blast and BPH
2	RGL 11414	ARS, Ragolu	Long duration, medium slender, non-lodging, non-shattering, low incidence of blast and bacterial leaf blight and tolerance to gall midge biotype 4
3	BPT 3082	ARS, Bapatla	Medium duration, resistant to blast
4	KNM 1638	ARS, Kunaram	Early duration, medium slender, moderately resistant to blast and gall midge
Checks			
1	MTU 1121	RARS, Maruteru	Short duration, medium slender grain, tolerant to blast and BPH
2	MTU 1061	RARS, Maruteru	Long duration, medium slender, tolerant to salinity and BPH
3	Aganni	RARS, Jagtial	Long duration, medium slender and resistant to gall midge

Table 2. Analysis of variance (mean squares) for yield and yield components in rice (*Oryza sativa* L.)

S. No.	Character	Mean sum of squares		
		Replications (d.f = 2)	Genotypes (d.f = 31)	Error (d.f = 62)
1	Days to 50% flowering	12.82	236.32**	2.49
2	Plant height (cm)	66.53	252.57**	8.58
3	Ear bearing tillers per plant	0.36	1.36**	0.14
4	Panicle length (cm)	0.02	6.39**	0.21
5	No. of filled grains per panicle	574.4	7507.60**	160.9
6	No. of grains per panicle	288	9439.90**	119.3
7	1000-grain weight (g)	0.86	34.39**	0.71
8	Grain yield per plant (g)	1.91	24.96**	1.18
9	Kernel length (mm)	0.03	3.81**	0.002
10	Kernel breadth (mm)	0.01	0.38**	0.01
11	Kernel L/B ratio	0.003	0.33**	0.005

*Significant at 5 per cent level, **Significant at 1 per cent level

Table 3. Mean performance of parents for yield and yield components in rice (*Oryza sativa* L.)

Entry	Days to 50% flowering	Plant height (cm)	Ear bearing tillers per plant	Panicle length (cm)	No. of filled grains per panicle	No. of grains per panicle	1000 grain weight (g)	Kernel length (mm)	Kernel breadth (mm)	Kernel L/B ratio	Grain yield per plant (g)
Lines											
MTU 1075	109	122.34	9.17	26.5	244	275.7	20.23	6.13	1.97	3.11	20.5
MTU 1224	104.3	113.3	9.1	25.23	255.7	278	14.64	5.24	1.8	2.91	19.1
RGL 2537	120	130.3	9.01	26.33	260.3	279.3	19.63	5.45	2.01	2.71	19.9
BPT 5204	113.3	98	8.72	24.43	203.7	225.7	14.74	5.17	1.74	2.93	18.2
MTU 7029	112	102.3	8.04	25.27	186.7	211	19.47	5.28	2.1	2.55	18.9
Minimum	104.3	98	8.04	24.43	186.7	211	14.64	5.17	1.74	2.71	18.2
Maximum	120	130.3	9.17	26.5	260.3	279.3	20.23	6.13	2.1	3.11	20.5
Mean	111.72	113.25	8.8	25.55	230.08	253.94	17.74	5.45	1.92	2.84	19.32
Testers											
MTU 1341	89.67	106.7	9.07	24.47	227.7	249.7	25.1	6.82	1.97	3.46	19.6
RGL 11414	123	120	8.74	25.4	220	254.7	25.68	5.92	2.28	2.6	20.9
BPT 3082	102	117.6	9.24	26.5	356.7	397.7	15.2	4.98	1.78	2.8	19.4
KNM 1638	88.67	108.3	9.23	24.53	236.3	245	14.57	5.21	1.66	3.14	20.9
Minimum	88.67	106.7	8.74	24.47	220	245	14.57	4.98	1.66	2.6	19.4
Maximum	123	120	9.24	26.5	356.7	397.7	25.68	6.82	2.28	3.46	20.9
Mean	100.83	113.15	9.07	25.22	260.83	286.77	20.14	5.21	1.78	2.93	20.2
SEd	1.32	2.38	9.92	0.34	10.69	9.09	0.72	0.04	0.09	0.06	0.93
CD (0.05)	2.68	4.81	20.07	0.67	21.65	18.41	1.46	0.08	0.19	0.12	1.89

Table 4. Mean performance of hybrids and checks for yield and yield components in rice (*Oryza sativa* L.)

S. No.	Entry	Days to 50 % flowering	Plant height (cm)	Ear bearing tillers per Plant	Panicle length (cm)	No. of filled grains per panicle	No. of grains per panicle	1000 grain weight	Kernel length (mm)	Kernel breadth (mm)	Kernel L/B ratio	Grain yield per plant (g)
1	MTU 1075 x MTU 1341	109	122.33	9.17	26.5	244	275.67	20.23	6.13	1.97	3.11	20.47
2	MTU 1075 x RGL 11414	104.33	113.27	9.1	25.23	255.67	278	14.63	5.24	1.8	2.91	19.14
3	MTU 1075 x BPT 3082	120	130.33	9.01	26.33	260.33	279.33	19.63	5.45	2.01	2.71	19.87
4	MTU 1075 x KNM 1638	113.33	98	8.72	24.43	203.67	225.67	14.73	5.17	1.74	2.97	18.22
5	MTU 1224 x MTU 1341	112	102.33	8.04	25.27	186.67	211	19.47	5.28	2.1	2.51	18.91
6	MTU 1224 x RGL 11414	89.67	106.67	9.07	24.47	227.67	249.67	25.1	6.09	1.97	3.09	19.61
7	MTU 1224 x BPT 3082	123	119.97	8.74	25.4	220	254.67	25.68	5.91	2.24	2.64	20.9
8	MTU 1224 x KNM 1638	102	117.61	9.24	26.5	356.67	397.67	15.2	4.89	1.71	2.86	19.38
9	RGL 2537 x MTU 1341	88.67	108.33	9.23	24.53	236.33	245	14.57	4.99	1.66	3.01	20.88
10	RGL 2537 x RGL 11414	107	122	9.13	25.6	237.67	263.33	23.07	5.92	2.73	2.17	25.95
11	RGL 2537 x BPT 3082	112.33	130.5	8.54	26.27	240.67	266.33	23.97	5.91	2.67	2.21	27.03
12	RGL 2537 x KNM 1638	103.33	102.33	9.15	26.3	155.67	170.67	19.13	5.85	2.58	2.27	25.98
13	BPT 5204 x MTU 1341	99.67	120.67	9.27	25.53	239	256.33	18.13	6.08	2.28	2.67	26.46
14	BPT 5204 x RGL 11414	100.67	122.67	9.56	28.77	305.67	348	20.7	5.91	2.44	2.42	24.62
15	BPT 5204 x BPT 3082	113.33	118	8.93	25.57	240.33	266	22.57	5.76	2.4	2.4	27.9
16	BPT 5204 x KNM 1638	102.33	117	9.16	25.87	330.33	347	15.83	5.04	2.06	2.45	24.57
17	MTU 7029 x MTU 1341	97	108.33	9.2	25.07	240.67	266.33	15.27	6.15	2.91	2.11	24.31
18	MTU 7029 x RGL 11414	107.67	124	9.14	25.43	243	265.67	23.33	5.84	2.66	2.2	24.87
19	MTU 7029 x BPT 3082	121.67	126.33	8.98	25.9	239.67	270.33	23.87	5.68	2.89	1.97	27.69
20	MTU 7029 x KNM 1638	110.67	129	9.12	26.6	302.67	337	17.97	5.69	2.23	2.55	25.27
	Minimum	88.67	98	8.04	24.43	155.67	170.67	14.57	4.89	1.66	1.97	18.22
	Maximum	123	130.5	9.56	28.77	356.67	397.67	25.68	6.15	2.91	3.09	27.9
	Mean	106.88	116.98	9.02	25.78	248.32	273.68	19.65	5.65	2.25	2.56	23.1
1	MTU 1121	106	113	9.13	28.07	246.7	278	20.23	5.83	2.02	2.88	19.9
2	MTU 1061	119	134	9.2	28.47	258	278.7	19.27	5.86	2.04	2.87	20.1
3	Aganni	90	110	5.75	21.37	147	176	20.47	5.85	1.89	3.08	13.2
	Mean	105	119	8.03	25.97	217.23	244.23	19.99	5.85	1.98	2.94	17.73
	SEd	1.32	2.37	9.92	0.34	10.69	9.09	0.72	0.04	0.09	0.06	0.93
	CD (0.05)	2.68	4.81	20.07	0.67	21.65	18.41	1.45	0.08	0.19	0.12	1.89

*Significance at 5 per cent level, **Significance at 1 per cent level

Table 5. Analysis of variance for combining ability (Line x Tester) for different traits in rice (*Oryza sativa* L.)

Source of variation	d.f.	Days to 50% flowering	Plant height (cm)	Ear bearing tillers per plant	Panicle length (cm)	No. of filled grains per panicle	No. of grains per panicle	1000 grain weight (g)	Kernel length (mm)	Kernel breadth (mm)	Kernel L/B ratio	Grain yield per plant (g)
Replications	2	10.25	79.79	412.42	0.09	530.79	272.84	0.79	0.03	0.01	0.01	1.91
Treatments	28	214.94**	239.98**	424.38**	3.67**	7236.71**	9397.78**	37.94**	3.83**	0.38**	0.36**	27.63**
Parents	8	115.56**	127.01**	680.31**	5.86**	9890.79**	14088.08**	30.61**	0.93**	0.17**	0.46**	7.13**
Hybrids	19	266.71**	286.03**	336.99**	2.85**	6499.07**	7830.44**	42.93**	4.29**	0.47**	0.27**	33.36**
Lines	4	84.833**	161.93**	619.40**	9.14**	14931.77**	20723.60**	31.88**	0.04**	0.03	0.08**	6.15**
Testers	3	185.42**	80.08**	78.56	0.78**	4515.00**	4314.33**	30.58**	0.83**	0.27**	0.38**	10.79**
Line x Tester	1	28.93**	128.09**	2729.25**	7.98**	5854.23**	16867.27**	25.61**	4.82**	0.47**	2.21**	0.03
Parents vs. Crosses	1	26.40**	268.76**	37.35	1.73**	19.38	1655.06**	1.78	18.41**	0.56**	1.24**	82.77**
Error	56	2.63	8.48	147.53	0.17	171.65	124.09	0.18	0.003	0.01	0.01	1.31
σ^2GCA		78.88	50.98	33.78	0.19	759.03	955.83	12.67	1.03	0.12	0.04	10.5
σ^2SCA		46.27	84.19	55.76	1.16	2323.84	2781.97	7.27	0.79	0.07	0.08	1.62
σ^2GCA/ σ^2SCA		1.705	0.61	0.61	0.16	0.33	0.34	1.74	1.31	1.61	0.48	6.48

*Significant at 5 per cent level, **Significant at 1 per cent level

Table 6. General combining ability (GCA) effects of parents for yield and yield components in rice (*Oryza sativa* L.)

Source	Days to 50% flowering	Plant height (cm)	Ear bearing tillers per plant	Panicle length (cm)	No. of filled grains per panicle	No. of grains per panicle	1000 grain weight (g)	Kernel length (mm)	Kernel breadth (mm)	Kernel	Grain yield per plant (g)
MTU 1075	4.78**	-1.01	-0.87	-0.15	-7.4	-9.02**	-2.35**	-1.19**	-0.37**	-0.07**	-3.67**
MTU 1224	-0.22	-5.34**	-8.32*	-0.37**	-0.56	4.57	1.71**	-0.92**	-0.25**	-0.08**	-3.40**
RGL 2537	-4.05**	-1.19	-0.41	-0.1	-30.73**	-37.35**	0.53*	0.65**	0.16**	0.06**	1.86**
BPT 5204	-2.88**	2.60**	6.76	0.65**	30.52**	30.65**	-0.35	0.81**	0.04	0.30**	2.78**
MTU 7029	2.36**	4.93**	2.84	-0.03	8.18*	11.15**	0.45	0.65**	0.42**	-0.2**	2.43**
MTU 1341	-5.62**	-4.58**	-1.36	-0.40**	-18.98**	-22.82**	-2.12**	-0.40**	-0.07*	-0.06**	-0.89**
RGL 11414	-5.02**	0.73	5.74	0.12	5.62	7.25*	1.71**	0.41**	0.07*	0.08**	-0.26
BPT 3082	11.18**	8.04**	-6.16	0.11	-8.12*	-6.35*	3.49**	0.31**	0.2**	-0.10**	1.57**
KNM 1638	-0.55	-4.20**	1.77	0.16	21.48**	21.92**	-3.08**	-0.32**	-0.19**	0.08**	-0.42
SE (gi)	0.42	0.76	3.14	0.1	3.38	2.88	0.23	0.01	0.03	0.02	0.3
SE ($gi - gj$)	0.6	1.06	4.43	0.15	4.78	4.07	0.32	0.02	0.04	0.03	0.93

*Significant at 5 per cent level, **Significant at 1 per cent level

Table 7. Specific combining ability (SCA) effects for yield and yield components in rice (*Oryza sativa* L.)

S. No.	Crosses	Days to 50%	Plant height (cm)	Ear bearing tillers per	Panicle length (cm)	No. of filled grains per	No. of grains per	1000 grain weight (g)	Kernel length	Kernel breadth	Kernel L/B ratio	Grain yield per plant
1	MTU 1075 x MTU 1341	2.95**	10.93**	7.07	1.27**	22.07**	33.82**	5.04**	1.04**	0.16*	0.26**	1.94**
2	MTU 1075 x RGL 11414	-2.31*	-3.45*	-2.55	-0. 51*	9.13	6.058	-4.38**	-0.67**	-0.14*	-0.09*	-0.025
3	MTU 1075 x BPT 3082	-2.85**	6.30**	6.53	0.59*	27.54**	21.02**	-1.16*	-0.36**	-0.06	-0.106*	-1.13
4	MTU 1075 x KNM 1638	2.21*	-13.79**	-11.06	-1.35**	-58.74**	-60.92**	0.51	-0.01	0.05	-0.063	-0.79
5	MTU 1224 x MTU 1341	10.95**	-4.72**	-22.81**	0.25	-42.10**	-44.43**	0.22	-0.08*	0.16	-0.28**	0.11
6	MTU 1224 x RGL 11414	-11.98**	-5.72**	4.09	-1.06**	-25.70**	-35.83**	2.02**	0.81**	-0.1	0.55**	0.17
7	MTU 1224 x BPT 3082	5.15**	0.28	4.99	-0.12	-19.63*	-17.23*	0.83	-0.17**	0.05	-0.15**	-0.38
8	MTU 1224 x KNM 1638	-4.12**	10.16**	13.72	0.93**	87.44**	97.5**	-3.08**	-0.56**	-0.11	-0.12**	0.09
9	RGL 2537 x MTU 1341	-8.55**	-2.87	8.6	-0.74**	37.74**	31.48**	-3.50**	-1.95**	-0.67	0.02	-3.18***
10	RGL 2537 x RGL 11414	9.18**	5.47**	-1.82	-0.19	14.47	19.75**	1.17*	0.57**	0.25**	-0.09*	0.25
11	RGL 2537 x BPT 3082	-1.68	6.66**	-9.59	0.47	31.20**	36.35**	0.29	0.55**	0.07	0.15**	0.49
12	RGL 2537 x KNM 1638	1.05	-9.26**	2.8	0.46	-83.40**	-87.58**	2.03**	0.83**	0.36***	-0.08	1.44*
13	BPT 5204 x MTU 1341	1.28	5.66**	2.77	-0.5	-20.85**	-25.18**	0.94	0.98**	0.05	0.34**	1.47*
14	BPT 5204 x RGL 11414	1.68	2.34	5.01	2.21**	-21.21**	36.42**	-0.32	-0.81**	0.07	-0.44**	-1.01
15	BPT 5204 x BPT 3082	-1.85	-9.62**	-3.76	-0.98**	-30.38**	-31.98**	-0.23	-0.05	-0.08	0.05	0.43
16	BPT 5204 x KNM 1638	-1.12	1.61	-4.02	-0.72**	30.02**	20.75**	0.39	-0.14**	-0.04	0.05	-0.9
17	MTU 7029 x MTU 1341	-6.63**	-8.99**	4.35	-0.28	3.15	4.31	-2.72**	0.01	0.31**	-0.34**	-0.33
18	MTU 7029 x RGL 11414	3.43**	1.34	-4.73	-0.43	-19.12*	-26.42**	1.51**	0.09**	-0.08	0.07	0.4
19	MTU 7029 x BPT 3082	1.23	-3.62*	1.82	0.03	-8.71	-8.15	0.27	0.03	0.03	0.04	0.58
20	MTU 7029 x KNM 1638	1.96*	11.27**	-1.44	0.68**	24.68**	30.25**	0.94	-0.13**	-0.25**	0.21**	0.15
	SE (*Sij*)	0.94	1.68	7.01	0.23	7.56	6.43	0.51	0.03	0.07	0.04	0.66
	SE (*Sij* -*Skl*)	1.32	2.37	9.92	0.34	10.7	9.09	0.72	0.05	0.1	0.06	0.93

*Significant at 5 per cent level, **Significant at 1 per cent level

of BPT 5204 x BPT 3082, MTU 1224 x BPT 3082, RGL 2537 x BPT 3082, BPT 5204 x MTU 1341 and RGL 2537 x KNM 1638 hybrids. These hybrids has also recorded significantly higher grain yield per plant (>25.0 g) compared to the checks, MTU 1121 (19.90) and MTU 1061 (20.10 g), in addition to high standard heterosis more than 30 per cent with desirable *sca* effects for grain yield per plant. Therefore, the above hybrids were identified as promising heterotic combinations for further evaluation and commercial exploitation as potential and early duration hybrids with semi tall to tall plant height, good spikelet fertility and short slender to medium bold grains (Sreelakshmi *et al*., 2019; Rasheed *et al*., 2021 and Nivedha *et al*., 2024).

CONCLUSION

The combining ability analysis for lines, testers and line x esters, revealed that non-additive gene action was predominant for majority of the yield components studie, namely,plant height, ear bearing tillers per plant, panicle length, filled grains per panicle, total grains per panicle and kernel L/B ratio, for exploitation of heterosis. In contrast, days to 50 per cent flowering, test eight, grain yield per plant, kernel length and kernel breadth has recorded preponderance of additive gene action. The crosses, BPT 5204 x BPT 3082, MTU 1224 x BPT 3082, RGL 2537 x BPT 3082, BPT 5204 x MTU 1341 and RGL 2537 x KNM 1638 were identified as the most promising heterotic combinations with potential for commercial exploitation, after testing over locations and years for their stability in performance.

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