IJPS INTERNATIONAL JOURNAL OF PLANT SCIENCES
ISSN-0973-1547 Volume **14** | Issue 1 | January, 2019 | 33-36
DOI: 10.15740/HAS/IJPS/14.1/33-36
Visit us - *www.researchjournal.co.in*

RESEARCH ARTICLE

Analysis of combining ability for yield and its contributing traits in rice (*Oryza sativa* L.)

■ **S.B. Verma**

SUMMARY

Among the pollinator lines Swarna followed by NDRK 5026 were found to be good general combiners rest of the lines were poor combiners for grain yield and its major components. Among the CMS lines PMS 10 was found good general combiners for grain yield and its major components characters. Among 24 hybrids studied IR58025A x MT 20-1-1, PMs 8 A x NDRK 5023, IR 58025 A x NDRK 5026 exhibited high sea effects for grain yield, days to 50 per cent flowering, plant height, total no of tillers per plant, panicle bearing tillers per plant and panicle length. The magnitude of SCA variances than GCA variances for all characters were much higher. Maximum GCA and SCA variance was recorded for total spiketets per panicle and grain yield, respectively. Due to negative GCA variances for panicle length and test weight the average degree of dominance and predictability ratio could not be work out.

Key Words : GCA, SCA, Rice combining ability

How to cite this article : Verma, S.B. (2019). Analysis of combining ability for yield and its contributing traits in rice (*Oryza sativa* L.). *Internat. J. Plant Sci.*, **14** (1): 33-36, **DOI: 10.15740/HAS/IJPS/14.1/33-36,** Copyright@ 2019: Hind Agri-Horticultural Society.

Article chronicle : Received : 11.10.2018; **Revised :** 08.12.2018; **Accepted :** 18.12.2018

Rice (*Oryza sativa* L.) is the most important food crop of the world. Rice belongs to family poaceae (Gramineae) having chromosome number (2n = 2 x = 24). The hybrid cultivar development their adoption are picking up very well in India. In rice so for cultivar has been using their own seeds of conventional varieties for several years without any replacement and the yields are satisfactory. However, the drawback associated with hybrid cultivar is that in next generation there is reduction in yield and also uniformity of grain and other characters due to inbreeding depression and segregation phenomenon operating in F_1. In view of this fact many times the farmers are advised not to use the seed of F_1 crop next year for seed purpose of phenomenon of inbreeding depression and reduction of yield. Till the year 2005 about 785 million tonnes of paddy which is 70 per cent more than current production will be need for meet the growing requirement (Manomani and Khan, 2003). The combining ability analysis is the important and major tools to estimate the combining ability effects for selection of desirable parents in breeding programme.

AUTHOR FOR CORRESPONDENCE

S.B. Verma, Department of Genetics and Plant Breeding (Agricutural Botany), Udai Pratap Autonomous College, **Varanasi (U.P.) India**
Email : sbvermaupc@gmail.com

MATERIAL AND METHODS

The present research work was undertaken to the

analysis of combining ability for yield and its contributing traits in rice at Genetics and Plant Breeding Farm of Narendra Deva University of Agriculture and Technology Kumarganj, Faizabad. The experimental material used for this investigation comprised of population of 24 F_1s, their parents 3 female, 8 male lines and 1 standard variety. The popular commercial variety used was Sarjoo 52. The F_1 hybrids and their parents seeds were sown on 20th June 1997 in nursery bed by treating with 0.2 per cent Bavistin solution for about a minute and then washed in water. After 25 days single seedling per hill were transplanted with 20 cm row to row and 15 cm plant to plant spacing having 4 rows of 2.5 meter long for each test entry in Randomized Block Design with three replications. The crop was maintained properly at 120:60:60 kg/ha NPK level and zinc sulphate at the rate of 25kg/he as usual half the nitrogen and entire quantities of phosphorus, potash and zinc sulphate was applied as basal dose and two split application of remaining 60 kg/ha nitrogen was tillering and panicle initiation stage. The experiment was grown under irrigated condition and all intercultural and plant protection measures were applied for raising a good crop. The analysis of combining ability was done on the basis of five randomly selected plant. The observation were recorded for seedling growth (cm) days to 50 per cent flowering, plant height (cm) total no of tillers per plant, panicle bearing tillers per plant, panicle length (cm), spikelets fertility per cent, spikelets per panicle test might (g) and grain yield (g) per plant. Combining ability was carried out form the method given by Kempthorne (1957).

RESULTS AND DISCUSSION

The line tester analysis was carried out for 10 characters and details of analysis are given in Table 1. The analysis of variance indicated that crosses and parents as whole were found to differ significantly. Variation within process and parents were significant for all the characters. Variation among parents vs process were also significant for all characters except days to 50 per cent flowering. The variations among male lines were observed to be significant for all the characters. Variation within female lines were found to be significant for all the characters except number of total tillers perplant, spikelet fertility per cent, test weight and grain yield per plant. The intraction between males and females were significant for all the characters except panicle length. The SCA variances were higher than GCA variances for all traits (Saidiah *et al.*, 2010).

General and specific combining ability:

The estimates of GCA effects of male line for grain yield were significant for three lines *i.e.* Swarna, NDRK 5026 and NDRK 5032 which were good general combiners with significant positive GCA effects. The GCA effects estimates of female lines only PMS 10 A was found with significant positive GCA effects on the performance and GCA effect NDRK 5026 and NDRK 5032 were found to be good general combiners out of twenty four hybrid studied for SCA effects eleven of the combination had SCA effects estimates in possitive direction and eleven showed negative values. However, four out of eleven hybrids having positive value were significant. Some of the promising hybrids in order of performance were IR 58025 A x MT 20-1-, PMS 8A x NDRK 5023, PMS 8 A x Swarna and IR 58025 A x NDRK 5026. Based on perse performance of hybrid as well as SCA effects some of the most promising hybrids for grain yield were PMS 8A x NDRK 5023, PMS 8 A x Swarna and IR 58025 A x NDRK 5026.

The knowledge of combining ability effect along with per se performance of parents and crosses help to breeder help in the selecting suitable parents, which combine well to produce superior hybrid it also helps to population which is ensential to plan appropriate breeding programme. General combining ability (GCA) effects

Table 1 : Analysis of variance for combining ability in rice

Source of Variation	d.f	Seedling growth (cm)	Days to 50% flowering	Plant height (cm)	Numbers of total tillers/ plant	Panicle bearing tillers/ plant	Panicle length (cm)	Total spikelets /Panicle	Spikelet fertility %	Test weight in (g)	Grain yield (g)
Replications	2	3.48	0.26	2.565	0.15	1.02	0.37	23.48	1.154	1.04	3.20
Females	2	85.09**	20.59**	595.93**	60.32**	25.11**	3.92	11793.92**	121.40**	2.22	128.10**
Males	7	97.53**	241.92**	366.67**	24.54**	23.86**	9.56**	6015.72**	145.191**	16.69**	211.33**
Females x males	14	35.92**	48.53**	249.26**	32.68**	36.20**	15.67**	1853.42**	0.18	6.26**	789.28**
Enron	68	1.24	1.64	4.11	0.99	0.55	1.37	15.97	2.82	0.94	1.67

largely involve additive genetic effects while specify combining ability effects represent non additive types of gene action (Griffing, 1966). The greater value of SCA than GCA variances were observed for 10 characters *viz.*, seedling growth, days to 50 per cent flowering, plant height, total no. of tillers per plant, panicle bearing tillers per plant, panicle length, spikelets per panicle, spiketets fertility per cent test weight and grain yield, indicating greater importance of non-additive gene action of all these traits. The inheritance of grain yield and yield components of rice were agreement with earlier finding of Saleem *et al.* (2010); Rashid *et al.* (2007); Manomani and Khan (2003); Saidaiah *et al.* (2010); Saravanan *et al.* (2006); Singh *et al.* (2004) and Vanjana *et al.* (2003).

General and specific combining ability effects:

Among the male parental lines Swarna was found on the whole good general combiners. It was consistently favourable significant GCA effects for all the 10 characters except panicle length, days to 50 per cent flowering, seedling growth and test weight.NDRK 5026 was another line which stood third good general combiners for all 10 characters except days to 50 per cent flowering, plant height, spikelets fertility per cent. Rest of the male lines were poor general combiners for grain yield and its major components however, some of them NDRK 5027, MT 20-1-1 were found good general combiners for earliness and the study of GCA effects for female parental lines revealed that PMS 10 was found to be good general combiners for grain yield and its major components.

Among 24 hybrids studied none of the hybrid exhibited high SCA effects for all 10 claracters. However, hybrid IR 58025 A x NDRK 5026 and PM 58 A x NDRK 5023 showed consistently favourable SCA effects in respect of 6 characters. The best cross IR 58025 A x NDRK 5026 exhibited high SCA effects for grain yields, no of total tillers per plant and days to 50 per cent flowering and moderalely high and desirable SCA effect for earliness. The cross IR 58025 A x NDRK 5023 exhibited high SCA effects for seedling growth.

The cross IR 58025 A x NDRK 5027 exhibited high SCA effect for plant height and PMS 10 A x NDRK 5023 exhibited high SCA effects for total number of tillers per plant. The cross PMS 8 A x NDRK 5031 exhibitede high SCA effects for panicle bearing tillers per plant and panicle length. The corss IR 58025 A x NDRK 5032 shows high SCA effects for total spikelets per panicle and the corss IR 58025 A x NDRK 5032 exhibited high SCA effects for spikelets fertility per cent. The cross

Table 2 : Estimates of general combining ability effects parents for 10 characters in rice

Parents	Seedling growth (cm)	Days to 50% flowering	Plant height (cm)	No of total tillers/ plant	Panicle bearing tillers/ plant	Panicle length (cm)	Total spikelet's /Panicle	Spikelet fertility %	Test weight in (g)	Grain yield/plant (g)
Males										
NDRK 5026	3.20**	-6.22**	0.62	0.38	0.68**	0.04	-35.88**	0.06	1.63**	2.17**
NDRK 5023	1.07**	1.89**	13.24**	0.13	0.33	-1.17**	1.46	-1.24*	-1.12**	0.25
NDRK 5031	-4.77**	4.22**	0.82	1.80**	2.37**	1.14**	49.78**	-7.80**	0.40	-6.97**
NDRK 5032	3.98**	-0.11	2.26**	2.63**	0.47	1.17**	14.30**	-1.04**	1.14**	1.19**
SWARNA	-2.69**	6.89**	-7.06**	0.74**	1.32**	0.27	11.88**	5.90**	-1.89**	9.70**
MT 20-1-1	-3.45**	-1.89**	-6.40**	-2.13**	-111**	-1.72**	-12.76**	-0.82	-1.45**	-0.36
NDRK 507	2.60**	2.33**	1.16	-0.73*	1.34**	0.28	-17.25**	3.30**	0.10	-2.31**
NDRK 5027	0.05	-7.11**	-3.41**	-1.79**	2.72**	0.53**	-12.39**	1.76**	1.60**	-3.16**
S.E. (Sij) ±	0.37	0.43	0.67	0.33	0.25	0.39	1.33	0.56	0.32	0.43
S.E. (gi-gj)±	0.52	0.60	0.96	0.47	0.35	0.55	1.88	0.79	0.46	0.61
Females										
IR58025 A	2.07**	0.56*	3.46**	0.59**	0.79**	0.43	24.99**	-1.78**	-0.09	-1.09**
PMS 8 A	-0.48*	0.51*	-5.71**	-180**	-115**	-0.05	-7.70**	0.75**	-0.25	-1.57
PMS 10 A	-1.61*	-1.07**	2.25**	-121**	0.36*	0.27	-17.29**	2.53**	0.34	2.65**
S.E. (Sij) ±	0.23	0.26	0.41	0.20	0.15	0.24	0.81	0.34	0.20	0.29
S.E.(gi –gj) ±	0.32	0.37	0.58	0.29	021	0.34	1.15	0.48	0.28	0.37

Where, * and ** indicate significance value at P = 0.05 and 0.01, respectively

Table 3 : Estimation of SCA effects for 10 characters in rice

Crosses	Seedling growth (cm)	Days to 50% flowering	Plant height (cm)	No of total tillers/ plant	Panicle bearing tillers/ plant	Panicle length (cm)	Total spikelet's /panicle	Spikelet fertility %	Test weight in (g)	Grain yield/plant (g)
IR 58025 A X NDRK 5026	-0.07	5.11**	11.24**	3.74**	3.05**	2.91**	7.26**	6.56**	0.74	18.28**
IR58025 A X NDRK 5023	6.05**	-4.89**	-3.29**	-4.01**	-3.77**	1.52*	-2.35	3.08**	-0.22	-12.97**
IR58025 A X NDRK 5031	-1.11	2.44**	2.85*	1.56**	1.36**	2.59**	37.70**	-17.82**	2.27**	1.09
IR58025 A X NDRK 5032	-1.86**	2.78**	3.18**	-2.84**	-0.74	-3.27**	-39.63**	-5.57**	-0.97	-12.08**
IR58025 A X Swarna	-1.18	0.78	0.64	-038	-0.59	-2.22**	-5.18	4.47**	0.06	11.52**
IR58025 A X MT 20-1-1	0.57	5.56**	-0.92	-231**	-2.99**	-0.76	-12.13**	10.03**	0.28	21.48**
IR58025 A X NDRK 507	-0.48	0.67	-0.71	4.09**	2.07**	-0.76	36.64**	-0.23	-0.73	-16.41**
IR58025 A X NDRK 5027	-1.93**	-2.22**	-12.99**	0.15	1.62**	-0.01	-18.56**	-0.79	-1.43*	-10.89**
PMS 8 A X NDRK 5026	-0.87	6.60**	-4.26**	-1.55**	-3.22	-1.77**	-1.68**	-4.21**	-0.74	-7.79**
PMS 8 A X NDRK 5023	-0.78	1.82**	6.71**	5.87**	5.01**	0.00	15.08**	0.54	-0.63	20.34**
PMS 8 A X NDRK 5031	-2.07**	3.51**	-6.53**	-1.47*	-2.12**	-1.39*	-19.65**	10.51**	-1.07	-10.93**
PMS 8 A X NDRK 5032	1.01	-2.85**	-7.48**	2.95**	5.04**	3.29**	-18.59**	-1.03	2.18*	11.73**
PMS 8 A X Swarna	6.02**	-3.18**	12.48**	2.69**	-3.31**	-0.71	-15.66**	0.33	0.65	20.69**
PMS 8 A X MT 20-1-1	-1.24	1.07*	1.69	0.45	0.72	0.72	6.65**	-4.84**	0.87	-13.54**
PMS 8 A X NDRK 507	-1.67**	-0.63	-8.79**	-2.89**	-2.32**	-1.28	32.72**	1.83	-1.31*	8.83**
PMS 8 A X NDRK 5027	-0.39	2.82**	6.18**	-0.67*	0.20	1.14	1.13	-2.03*	1.06	12.75**
PMS 10 A X NDRK 5026	0.94	-1.49**	-6.97**	-2.20**	0.17	-1.14	8.95**	-2.35**	0.00	-10.38**
PMS 10 A X NDRK 5023	-5.27**	3.07**	-3.42**	-1.86**	-1.24**	-1.51	-12.73**	-2.53**	0.85	-7.38**
PMS 10 A X NDRK 5031	3.18**	1.07*	3.69**	-0.09	0.76	-1.20	-18.06**	7.31**	-1.20*	9.85*
PMS 10 A X NDRK 5032	0.85	0.07	4.29**	-0.11	-4.31**	-0.02	-20.89**	6.60**	-1.21*	0.35
PMS 10 A X Swarna	-4.84**	2.40**	-13.12**	3.07**	3.91**	2.92**	20.84**	-5.06**	0.29	9.17**
PMS 10 A X MT 20-1-1	0.67	-4.49**	-0.77	1.86**	2.27**	0.04	5.48*	-5.19	-1.15*	-7.93
PMS 10 A X NDRK 507	2.15**	-0.04	9.50**	-1.20*	0.25	2.04*	-1.08	-1.59	2.04**	8.18**
PMS 10 A X NDRK 5027	2.32**	-0.60	6.80**	0.52	-1.81**	-1.13	17.44**	2.82**	0.37	-1.86
S.E. Sis ±	0.64	0.46	1.17	0.57	0.43	0.67	2.31	0.97	0.56	0.76
S.E. (SIJ – SKL) ±	0.91	1.04	1.65	0.81	0.60	0.95	3.26	1.37	0.79	1.05

* and ** indicate significance of values at P=0.05 and 0.01, respectively

IR 58025 A x NDRK 5031 showed high SCA effects for test weight and cross IR 58025 A x MT 20-1-1 exhibited hight sea effects for grain yield.

REFERENCES

Griffing B. (1966). Concept of general combining and specific combining ability in relation to diallel crossing system. *Aust. J. Bio. Sci.*, **9** : 463 - 493.

Kempthorne, O. (1957). *An introduction to genetic statistics*, John Wiley & Sons.

Manomani, S. and Khan, A.K. Fazlullah (2003). Studies on combining ability and heterosis in rice. *Madras Agric J.*, **90**: 228-231.

Rashid, M., Cheema, A.A. and Ashraf, M. (2007). Line x Tester analysis in basmati rice. *Pakistan J. Bot.*, **36** (6): 2035-2042.

Saidaiah, P., Sudheer Kumar, S. and Ramesha, M.S. (2010). Combining ability studies for development of new hybrids in rice over environments. *J. Agric. Sci.*, **2** (2):225-233.

Saleem, M.Y., Mirza, J.I. and Hag, M.A. (2010). Combining ability analysis for yield and yield related traits in basmati rice (*oryza sativa* L.). *Pak. J. Bot.*, **42** (1) : 627-637.

Saravanan, K., Ramya, Satheesh Kumar, P. and Subesan, T. (2006). Combining ability for yield and quality traits in rice (*Oryza sativa* L.). *Oryza* , **43** (4) : 274-277.

Singh, A., Kumar, N.K. and Chaudhary, V.K. (2004) line x tester analysis for grain yield and related traits in rice. *Madras Agric. J.*, **94** (4-6):211-214.

Vanjna, T., Babu, L.C., Radhakrishnan, V.V. and Pushkaran, K. (2003). Combining ability for yield and yield components in rice varieties of diverse origin. *J. Tropi. Agric.*, **41**(1/2) : 7-15.