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Estimation of components of variance, degree of dominance and heritability in Rice (O*ryza sativ*a L.)

S. B. VERMA[1], KAYAM SINGH, SASHI BALA[2], RAJU JATAV[3] AND MONIKA BHASKAR[4]
Senior Scientist & Head KVK, Sheopur, RVSKVV, Gwalior M.P.

Abstract

Themagnitude of sca variance were much higher than that of gca variance for all the characters. The maximum gca variance (427.35) and sca variance (846.71) was recorded for total spikelet's per panicle and grain yield respectively. The negative s^2g was observed for days to 50% flowering. Panicle bearing tillers, panicle length spikelet's fertility %, test weight and grain yield.

Key words: Rice, Variance, Fertility, Additive gene action, Genetic component

Introduction

Rice is the most important food crop of the world. It belongs to the family Poaceae (Gramineae) having chromosome number (2*n*=2*x*=24). The ultimate aim of the plant breeding is to develop varieties that perform certain functions better than the existing type. The superiority of the improved type is manifested by certain specific gene combinations and how rapidly these combinations can be obtained in single crop variety depend on the system into which the genes available to the plant breeder are organized. Initially, varietal improvement was restricted to the use of the various selection parameter coupled with introgression and or selection of favorable plant types in autogamous plants limited to utilization of fixable gene effect only. Considering the progress made in research and development of hybrid rice technology in China and research experiences of gained at IRRI and other research centers, so for, one can say that hybrid rice technology is one of the possible way to increase varietal productivity in the rice (about 1 ton/hec.) beyond the limits set by improved semi dwaric rice varieties, keeping in view, certain traits of hybrids such as dominant gene for resistance stress situation (Senadhira and Virmani 1987 and Kaw and Khush 1985), better use of Physiology efficiency (Mc. Donald *et al*. 1987, Lin and Yuan 1980), stronger and active root system (Virmani*et al*. 1981) early seedling and vegetative vigour (Akita *et al*. 1986) and adoptability under problematic soil condition (Akbar and Yabura 1975), the study a of rice grains added significant.

Materials 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 in nursery bed by treating with 0.2% Bavistin solution for about a minute and then washed in water. After 25 days single seedling per hill were transplanted with20 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

[1]Assistant Professor, Department of Agricultural Botany (Genetics and Plant Breeding) Udai Pratap College, Varanasi Uttar Pradesh,
[2]Assistant Professor, Department of Horticulture, Udai Pratap College ,Varanasi Uttar Pradesh
[3]RAEO, Sheopur FW&AD Departt. Of M.P & BTM, ATMA Bhind, FW&AD Departt. Of M.P.
[4] BTM, Farmers welfare and Agriculture Development Dept. Bhind M.P.

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% flowering, plant height (cm) total no of tillers per plant, panicle bearing tillers per plant, panicle length (cm), spikelet's fertility %, spikelet's 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 estimates of genetic components gca variance (g) and sca variance (r^2s) were calculated from the variance of combining ability. The average degree of dominance (r^2 S/ r^2g / r^2) and predictability ratio ($2r^2g/r^2g+r^2s$) was also worked out. A 1:1 ratio between r^2g and r^2s indicates an equal importance of additive and non additive gene action for expression of the characters, while deviation from 1:1 ratio indicates were importance of r^2g or r^2s depending upon the magnitude of ratio. Due to negative estimates of r^2g for panicle bearing tillers, panicle length, total spikelets per panicle, spikelets fertility % and test weight, the corresponding value of average degree of dominance and predictability ratio were not workout. The estimates of genetic components along with average degree of dominance and predictability ratio have been presented in Table 1.

The magnitudes of sca variance were much higher than that of gca variances for all the characters. The maximum gca variance (427:35) and sca variance (846.71) was recorded for total spikelet's per panicle and grain yield respectively. The negative (r^2g) was observed for days to 50% flowering, panicle bearing tillers, panicle length, total spikelets per panicle. Spikelet's fertility % test weight and grain yield. The higher values of degree of dominance and lower predictability ratio were also observed for all 10 characters. This is suggested that non additive gene action effects played an importance role in the expression of these characters.

The present finding are in accordance with other observations make by Rao *et al*. 1980, Singh and Srivastava 1982, Sardana and Borethakm 1987, Viraktamath 1987, Mishra 1988, Maury and Singh 1976, Singh *et al*. 1979, Haque*et al*. 1981, Rahman *et al*. 1981, Subramanian and Rathinam 1984. and Sarthe and Singh 1986; Ariful Islam *et al*. 2015, Cheema *et al*. 1985 and Robinson *et al*. 1949.

Contribution of males and females and males x females in percentage

The percent contribution of males; females and males x females in respect of 10 character are given in Table 2. The percent contribution of males and females were more than 60 percent for five characters, grain yield (86.42), panicle length (74.58), panicle bearing tillers per plant (69.99) spikelet's fertility % (67.14) and no of total tillers per plant (60.56).The 'males' contributed 50 percent for three characters, days to 50% flowering (67.61), test weight (55.90) and seedling growth (50.35%). None of the 'females' contributed more than 26 percent. The

Table 1: Estimate of components of variance, degree of dominance, additive (r^2A) and dominance (r^2D) heritability in narrow souse (h^2n) for 10 characters

Characters	r^2f F	r^2f M	r^2g Pooled	r^2S	(r^2S/r^2g) ½	$2r^{2g}/2r^2g + r^2S$	r^2A	r^2D	h^2n
Seedling growth (cm)	2.05	6.85	3.35	11.56	1.85	0.36	6.71	11.56	33.83
Days to 50% flowering	-1.16	18.49	4.19	15.66	2.04	0.34	8.39	15.66	32.63
Plant height (cm)	14.44	13.05	14.06	82.07	3.74	0.25	28.13	82.07	26.60
No. of total tillers/plant	1.18	-0.84	0.62	10.42	0.78	0.10	1.26	10.42	9.80
Panicle bearing tillers/plant	-0.46	-1.37	0.70	11.86	0.8	0.10	-1.42(0)	11.86	10.13
Panicle length	-0.49	-0.68	0.54	4.91	0.73	0.18	-1.08(0)	4.91	14.67
Total spikelets/Panicle	414.19	462.48	427.35	615.55	20.67	0.58	854.72	615.55	57.56
Spikelets fertility	-2.60	-4.29	3.06	61.01	1.74	0.09	-6.12	61.01	8.74
Test weight (g)	-0.17	1.16	0.19	1.71	0.43	0.18	0.39	1.71	15.58
Grain yield (g)	38.43	-226.36	89.68	846.71	9.46	0.17	-179.37	846.71	17.45

Where, r^2g = variance due to gca r^2s = Variance due to sca (r^2s/r^2g) ½ degree of dominance $2r^2g/2r^2g + r^2s$ Predictability ratio (- ratio no calculated due to negative r^2g)

Table 2: Percent contribution of male and females and males x females

S. No. Characters	Males	Females	Males x Females
1. Seedling (growth (cm.)	50.4%	12.55%	37.09%
2. Days to 50% flowering	67.61%	18.50%	30.53%
3. Plant height (cm)	35.41%	16.44%	48.13%
4. No. of total tillers/plant	23.16%	16.26%	60.56%
5. Panicle bearing tillers/plant	23.06%	69.3%	69.99%
6. Panicle length (cm.)	22.74%	26.60%	74.58%
7. Total spikelets/ Panicle	45.94%	25.99%	28.31%
8. Spikeletsfertility %	26.53	6.23%	67.14%
9. Test weight (g)	55.90%	2.12%	41.95%
10. Grain yield (g)	11.57%	20.00%	86.42%

maximum contribution of female percent was (25.99%) for total spikelets per panicle followed by 16.44% for plant height and total number of tillers per plant (16.26).

References

Akbar and Yabura, T. (1975). Breeding for saline resistant varieties of rice III response of F_1 hybrids to salinity in reciprocal crosses between Jhora 349 and Mongolia Janpn J. Breed, 25: 215-220.

Akita, S.; Blanco, L. and Virmani, S.S. (1986). Physiological analysis of heterosis in rice plant. Japan, crop sci., (5, Extra Issue 1: 14-15).

Arifal Islam, M.D.; Khaleque Mian, M.A.; Golam Rasul; Khalique, Q.A. and Akhanda, M.A. (2015). Estimation of gene action and variance components of some reproductive traits of rice through linex tester analysis J Rice Res 3: 144.

Haque, M.M., Farid, N.I., Razzaque, C.A. and Newaz., M.A. (1981). Combining ability for yield and component characters in rice Indian J. Agric. Sci., 51 (10):711-714.

Kaw, R.N. and Khush G.S. (1985). Heterosis in traits related to low temperature tolerance in rice, philip. J. crop sci., 10: 93-105.

Lin, S.C. and Yuan, L.P. (1980). Hybrid rice breeding in china, Innovative Approaches to Rice Breeding, IARI, Los Banos, Laguna Philippines, P. 35-35.

Maurya, D.M. (1976). Heritability and genetic advance in rice. Oryza, 13 (2) 97-100.

Mishra, S.B. (1988). A Study on Hybrid rice Ph.D thesis, NDUAT, Faizabad U.P. India

Rahman, M.A.; Patwary, A.K. and Miah (1981). Combining ability in rice. Indian J. Agric. Sci., 51 (8): 543-546.

Rashid, M.; Cheema, A.A. and Ashraf, M. (2007). Linex tester analysis in Basmati rice, Pakistan Bot., 36 (6): 2035-2042.

Rao, A.V.; Krishna, S.T. and Prasad, A.S.R. (1980). Combining ability in rice: Indian J. Agric. Sci., 50: 193-197.

Saleem, M.Y.; Mirza, J. I and Haque, M.A. (2010). Combining ability analysis for yield and related traits in Basmati rice (*Oryza Sativa L.*) Pak. J. Bot., 42 (1): 627-637.

Senadhira, D. and Virmani, S.S. (1987). Survival of some F_1, hybrids and their parents in saline soil. Inc. Rice Res. News Letter, 12 (1); 14-15.

Sarthe, M.L. and Singh, S.P. (1986). Combining ability for yield and related characters in rice. Oryza, 23; 224-228.

Singh, S.P. and Srivastava, M.N. (1982). Combining ability and Heterosis in components of grain yield and Panicle geometry in rice Indian J. Agric. Sci., 52; 271-277.

Sardanan, R. and Borthakur, D.H. (1987). Combining ability for yield in rice, Oryza. 24 (1): 14-18.

Singh, R.P. and Singh, R.R. (1979). Heterosis in rice Oryza, 15 (2) 119-122.

Subramanian, S. and Rathinam, M. (1984). Study of combining ability for yield components in rice. Madras Agric. J., 71 (7): 431-438.

Virmani, S.S.; Chaudhary, R.C. and Khush, G.S. (1981). current outlook on hybrid rice. Oryza, 18: 67-84.