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DISSECTION ON GENETIC VARIABILITY AND SELECTION CRITERIA FOR YIELD AND ITS CONTRIBUTING TRAITS IN NEWLY DEVELOPED RICE HYBRIDS (*Oriza sativa* L.)

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ABSTRACT

Forty eight newly developed notified and un-notified rice hybrids from public and private sectors including with standard checks viz., Delta Express, PA 6444 and PHB 71 were evaluated in Randomized Block Design with three replications during kharif 2010 at CRF, Nawabganj, Chandra Shekhar Azad University of Agriculture and Technology, Kanpur (U.P) India to study eight quantitative traits. The variance due to overall treatment was significant for all the character while the variances due to replication was highly significant for days to flowering and only significant for grain yield/plant. Highest genotypic as well as phenotypic coefficient of variation was observed for grain yield followed by productive tillers/m2, grains/panicle, panicle length and test weight. Productive tillers and plant height showed both high heritability and genetic advance. Heritability and genetic advance indicated additive gene action and reliability of these characters for effective selection. Grain yield was strongly associated with Productive tillers, panicle length, grains/panicle, spikelet fertility and test weight through direct effect of these characters also. These emerged as direct contributors which would be utilized for selection criteria in breeding programme to develop high yielding hybrid cultivars with desirable traits.

Key words : *Variability parameters, inter-relationship, cause and effect, interspecific hybrids*

Rice is the prominent staple food crop of India grown on 43.3 million hectares and its production has crossed 100 million tons for the first time during 1011-12. We can not be satisfied with this achievement, as additional 27 million tons of rice to be produced to meet the targeted production by 2025. This enhanced production has to be achieved from declining natural resources like land, fertility and water. Among various efforts being made to enhance the production and productivity of the rice, research on rice hybrids has become most crucial. Uttar Pradesh is contributing about 13 percent rice to the total national production. Considering the acceptability of hybrids among farmers, the targets have gone from 1.20 lakh ha areas in 2004 to 14.02 lakh ha in the year 2010. Similarly, the achievements against targets have also increased from 0.98 lakh ha to 11.95 lakh ha area during the same period.

The nature and extent of genetic variation governing the nature of inheritance traits and association will be facilitate effective genetic improvement. It is evident that information on agro-morphological and physiological aspects of crop is also key features to plan a effective breeding programme. Thus, the genetic restriction of crop plant design is required for developing high yielding crop varieties.

Correlation coefficient is a statistical measure which determines the degree (strength) and direction of relationship between two or more variable. The better way to exploiting genetic correlation and path coefficient with several traits having high heritability is to construct a selection index that combines information on all the characters associated with the dependent variable. Wide difference between genotypic and phenotypic correlations between two characters is due to dual nature of phenotypic correlation which is determined by genotypic and environmental correlations and heritability of the characters. Keeping in view the above perspectives, the present research work was taken up to assess variability and associations between various components of grain yield to provide basis for selection and yield improvement in rice hybrids.

MATERIALS AND METHODS

A total of 48 rice hybrids including three checks viz. Delta Express, PA 6444 and PHB 71 were evaluated in Randomized Block Design during kharif 2010 at Crop Research Farm, Nawabganj, C.S. Azad University of Agriculture and Technology, Kanpur (UP). Each genotype was laid out in 10 m2 plot size following row to row and plant to plant spacing of 20 cm and 15 cm, respectively, The recommended dose of fertilizers N:P:K @ 150:60:60, cultural package and practices were followed to raise a healthy crop. The observations were recorded on the basis of ten randomly selected plants for different characters except for grain yield were recorded on the basis of per plot. The data were recorded on days to 50% flowering, plant height (cm), productive tillers/m^2, number of grains per panicle, spikelet fertility (%), panicle length (cm), test weight (g), and grain yield per plot (kg).

Statistical analyses were subjected to method suggested by (1) for analysis of variance, genotypic and Phenotypic coefficients of variation (2), estimate of broad sense heritability (h^2b) (4) and genetic advance as percent of the mean, was computed by the method suggested by (3), character association (4) and path by (5).

RESULTS AND DISCUSSION

Highly significant variance for all the characters due to treatments were observed under study while the variances due to replication was non-significant for all the traits except for days to flowering (19.50) and grain yield per plot (2.01). The phenotypic coefficient of variability (PCV) as well as genotypic coefficient of variability (GCV) was close for more of the traits except grain yield per plot (34.39 and 31.39) and plant height (11.30 and 9.73) which indicated considerable amount of environmental effect on the total phenotypic variation. Phenotypic coefficient of variability (PCV) was higher than genotypic coefficient of variability (GCV) for all the traits at both the levels (Table-2). These traits exhibited higher variation for GCV and PCV across the environment (6). High order of PCV and GCV at both levels was observed for grain yield per plot (34.39 and 31.39) and productive tillers/m2 (21.29 and 20.57) (7, 8). It suggested greater scope for selection because of GCV and PCV alone is not helpful in determining the heritable portion (2) also suggested that GCV and heritability estimates would give better information about the efficiency of selection. Moderate PCV and GCV at both level chronicled only in case of grains/panicle (15.59 and 14.74), panicle length (12.68 and 11.89), test weight (12.24 and 11.95) and plant height (11.30 and 9.73) while very low to low order of variation was recorded for remaining characters. The high estimates of broad sense heritability and moderate genetic gain was recorded for number of productive tillers/m2 and plant height similar findings were also concluded by (6, 7).

Correlation and path coefficient at both genotypic and phenotypic level are summarized in Tables-3 and 4, respectively. There were strong positive and highly significant correlation between grain yield per plot and productive tillers/m2 (0.773 and 0.720), panicle length (0.536 and 0.477), grains/panicle (0.501 and 0.467), spikelet fertility (0.429 and 0.359) and test weight (0.393 and 0.359) at both of the levels, also reported

Table-1: Mean squares of 8 different characters in rice hybrids.

Characters	Sources of variation		
	Replication (2)	Treatment (47)	Error (94)
Days to 50% flowering	19.50**	49.62**	3.32
Plant height	32.13	418.64**	43.79
Productive tillers/m^2	5.08	280.65**	6.51
Grains per panicle	5.68	60.90**	2.31
Spikelet fertility	4.875	72.89**	13.30
Panicle length	1.21	28.62**	1.20
1000- grain weight	0.012	23.58**	0.37
Grain yield per plot	2.01*	9.02**	0.47

*, ** significant at 5% and 1% level of probability, respectively.

Table 2: Estimates of general mean, phenotypic (PCV), genotypic (GCV) and environmental (ECV) coefficient of variation, heritability in broad sense (h2b) and genetic advance in per cent of mean for 8 characters in rice hybrids.

Characters	General mean ± SE	Coefficient of variation (%)			Heritability in broad sense (%)	Genetic advance in per cent of mean
		PCV	GCV	ECV		
Days to 50% flowering	92.52 ± 1.48	4.68	4.25	0.43	82.30	7.34
Plant height (cm)	114.90 ± 5.40	11.30	9.73	1.57	74.00	19.81
Productive tillers/m^2	464.78 ± 20.83	21.29	20.57	0.72	93.30	19.03
Grains per panicle	299.84 ± 12.40	15.59	14.74	0.85	89.40	8.61
Spikelet fertility	83.60 ± 2.97	6.89	5.33	1.56	59.90	7.10
Panicle length (cm)	25.40 ± 0.91	12.68	11.89	0.79	88.00	5.84
1000-grain weight (g)	23.27 ± 0.49	12.24	11.95	0.29	95.40	5.60
Grain yield per plot (kg)	5.30 ± 0.56	34.39	31.39	3.00	85.60	3.22

by (12), (11). Productive tillers/m2 at both levels showed highly and positive association only with spikelet fertility (0.427 and 0.347) and panicle length (0.484 and 0.443) that could be increased simultaneously through selection of these component traits (Table-3).

Direct effect of number of productive tillers/m2 (0.624 and 0.544) followed by grains/panicle (0.217 and 0.230), panicle length (0.192 and 0.164) at both levels was positive, while only days to 50% flowering and plant height showed negative direct effect on grain yield/plot. Productive tillers/m^2, grains panicle and panicle length at both levels were expressed higher direct effect which are mainly responsible for increasing yield positively (10). Panicle length (0.302 and 0.241), spikelet fertility (0.266 and 0.189), and productive tillers/m^2 (0.076 and 0.076) at both levels were exhibited high positive indirect via direct effect of productive tillers/m^2 on grain yield/plot. This result indicated that panicle length, spikelet fertility, productive tillers/m^2 had a great effect on grain yield (9).

Table 3: Estimates of genotypic and phenotypic correlation coefficients between 8 characters in rice hybrids.

Characters	Level	Days to 50% flowering	Plant height (cm)	Productive tillers/m^2	Grains per panicle	Spikelet fertility (%)	Panicle length (cm)	1000-grain weight (g)	Grain yield/ plot (kg)
Days to 50% flowering	rg	1.00	0.226	-0.63	-0.070	-0.154	-0.204	-0.191	-0.170
	rp	1.00	0.185	-0.039	-0.058	-0.079	-0.190	-0.067	-0.153
Plant height (cm)	rg		1.00	0.141	-0.064	-0.273	0.053	-0.405	-0.251
	rp		1.00	0.112	-0.060	-0.167	0.048	-0.346	-0.204
Productive tillers/m^2	rg			1.00	0.351	0.427**	0.484**	0.269	0.773**
	rp			1.00	0.329	0.347	0.443**	0.260	0.720**
Grains per panicle	rg				1.00	0.089	0.221	0.033	0.501**
	rp				1.00	0.082	0.217	0.022	0.467**
Spikelet fertility	rg					1.00	0.129	0.141	0.429**
	rp					1.00	0.115	0.084	0.359*
Panicle length (cm)	rg						1.00	0.232	0.536**
	rp						1.00	0.212	0.477**
1000- grain weight (g)	rg							1.00	0.393**
	rp							1.00	0.359*
Grain yield per plot (kg)	rg								1.00
	rp								1.00

*, ** Significant at 5% and 1% probability levels, respectively.

Table 4: Direct and indirect effects of 7 characters on grain yield/plot in hybrid rice on Genotypic and Phenotypic level.

Characters	Level	Days to 50% flowering	Plant height (cm)	Productive tillers/m^2	Grains per panicle	Spikelet fertility (%)	Panicle length (cm)	1000-grain wt. (g)	Correlation with Grain yield/plant
Days to 50% flowering	Pg	**0.021**	-0.083	-0.039	-0.015	-0.005	–0.039	-0.009	-0.170
	Pp	**-0.028**	-0.039	-0.021	-0.013	-0.006	-0.031	-0.014	-0.153
Plant height	Pg	0.005	**-0.314**	0.088	-0.014	-0.008	0.010	-0.019	-0.251
	Pp	-0.005	**-0.211**	0.061	-0.014	-0.013	0.008	-0.029	-0.204
Productive tillers/m^2	Pg	-0.001	-0.044	**0.624**	0.076	0.013	0.093	0.012	0.773
	Pp	0.001	-0.024	**0.544**	0.076	0.028	0.073	0.022	0.720
Grains per panicle	Pg	-0.001	0.020	0.219	**0.217**	0.003	0.043	0.002	0.501
	Pp	0.002	0.013	0.179	**0.230**	0.007	0.035	0.002	0.467
Spikelet fertility	Pg	-0.003	0.086	0.266	0.019	**0.030**	0.025	0.007	0.429
	Pp	0.002	0.035	0.189	0.019	**0.080**	0.019	0.007	0.359
Panicle length(cm)	Pg	-0.004	-0.017	0.302	0.048	0.004	**0.192**	0.011	0.536
	Pp	0.005	-0.010	0.241	0.050	0.009	**0.164**	0.018	0.477
1000- grain weight	Pg	-0.004	0.127	0.168	0.007	0.004	0.045	**0.046**	0.393
	Pp	0.005	0.073	0.141	0.005	0.007	0.035	**0.085**	0.359

Residual factors: Genotypic = 0.1998 and phenotypic = 0.3176, Bold figures indicates indicate direct effects.

REFERENCES

1. Panse, V.G. and Shukhatme, P.V. (1967). Statistical Methods for agricultural workers. 2nd Edn. ICAR, New Delhi, pp. 152-157.
2. Burton, G.W. and de Vane, E.W. (1953). Estimating heritability in tall fescue (*Fistuea arundincea*) from replicated clonal material. *Agron. J., 45 :* 178-181.
3. Johnson, H.W.; Robinson, H.F. and Comstock, R.E. (1955). Estimates of genetic and environmental variability in Soybean, *Agron. J., 47* : 314-318.
4. Al-jibouri, H.A.; Miller. P.A.; Robinson, H.F. (1958). Genetic and Environmental variance and covariance in an upland cotton cross of interspecific origin. *Agro. J. 50 :* 633-637.
5. Dewey, D.R. and Lu, K.H. (1959). A correlation and path coefficient analysis of components of crested wheat grass seed production. *Agron. J., 51:* 515-518.
6. Soyoum, M. Alamerew, S. and Bantte, K. (2012). Genetic variability, Heritability, correlation and path analysis for yield and yield related traits in upland rice. *Oryza 7 (1) :* 13-22.
7. Singh, S.P.; Singh, R.P.; Srinivasulu, K. and Prasad, J.P. (2006). Studies on genetic variability, character association in diverse lines of international irrigated observation nursery of rice (*Oryza sativa* L.). *Research on Crops, 7 (3):* 714-719.
8. Yadav, S.K., Pandeey, P.; Kumar, B. and Suresh, B.G. (2011). Genetic Architecture, Inter-relationship and Selection criteria for yield Improvement in rice (*Oryza sativa* L). *Pakistan J. of Biol. Science. 14 (9) :* 540-545.
9. Patil, P.V. and Sarawgi, A.K. (2005). Studies on genetic variability correlation and path analysis in traditional aromatic, rice accessions. *Annals of Plant Physiology. 19 (1) :* 92-95.

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