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Systematic Evaluation of Exotic Rice Germplasm for Yield Component Characters and Its Grain Yield

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Abstract: *The present investigation was carried out with the objective to collect the basic information's on genetic variation, heritability, genetic advance and correlation coefficient for 11 quantitative characters. PCV was higher than the GCV for 11 character studied, indicating little role of environment on the expression of these characters. Among the 67 rice genotype evaluated under Allahabad conditions, on the basis of per se performance IR72860-74-1-2-1 genotypes was found to be superior in terms of yield and its attributing character namely number of spikelet's / panicle , flag leaf length , grains yield and number of tiller / plant.*

1. INTRODUCTION

India is the largest rice growing country in world. However, its productivity per unit area by world standard is low. In order to increase rice productivity, high yielding and disease resistant varieties should be developed .Knowledge on the genetic architecture of genotypes is necessary to formulate efficient breeding methodology. It is essential to find out the relative magnitude of additive and non additive genetic variances, heritability and genetic gain with regard to the characters of concern to the breeder. Breeding strategies is chiefly influenced by the choice of germplasm. Any wrong choice of germplasm to initiate the selection process results in the wastage of resources. The systematic breeding programme involves the steps like creating genetic variability practicing selection and utilization of selected genotypes to evolve promising varieties. In a rice improvement programme, it is a germplasm, which virtually determine the success and nature of end product (Pandey etl.2009). The development of superior rice population involved the intelligent use of available genetic variability both indigenous as well as exotic to cater the need of various farming situations of rice. The grain yield is the primary trait targeted for improvement of rice productivity in both favorable and unfavorable environments from its present level .The major function of heritability estimates is to provide information on transmission of characters from the parents to the progeny. Heritability estimates can anticipate improvement by selection of useful characters. Hence, objectives of the present study is to assess the genetic variability among 67 rice germplasm and to study the interrelationship among the characters with seed yield

2. MATERIALS AND METHODS

The experiment was laid out with 67 rice genotypes in a Randomized Block Design with 3 replications at the field experiment centre of the Department of Genetic and Plant Breeding, School of Agriculture, Sam Higginbottom Institute of Agriculture, Technology and Science (Formerly Allahabad Agriculture Institute), Deemed to be University Allahabad During kharif. Recommended packages of practices were followed for superior crop growth. The data were recorded five randomly selected plants from each replication leaving the first two border rows from all the four sides, in order to avoid the sampling error. The observations were recorded as per the following procedure. Readings from five plants were averaged replication wise and the mean data was used for statistical analysis for the 12 characters. Analysis of variance was done according to procedure given by Panse and Sukhatme (1967). The formula used to calculate PCV, GCV and ECV were given by Burton (1952). Heritability was calculated by the formula given by Lush (1949) and Burton and Devane (1953).

3. RESULTS AND DISCUSSION

Analysis of variance among 67 genotypes showed significant differences for all the character under study, thus suggesting that the genotypes were genetically variable and indicating the presence of substantial genetic variability. A perusal of mean performance revealed that genotype IR7286-74-1-2-1 has highest mean performance for yield per plant (28.33g) and maximum number of spikelet's per panicle genotypes CT17381-16-1-2-4-3-M (230.36). Genotype HIPA4 recorded highest mean performance for Harvest index (34.60%) and genotype RADHAKRISHNA9 recorded highest mean performance for plant height (162.03cm). Less difference in the estimates of genotypic and phenotypic variance and higher genotypic values compared to environment variances for all the character suggested that the variability present among the genotypes were mainly due to genetic reason with minimum influence of environment and hence heritable. The estimation of phenotypic coefficient of variation and genotypic coefficient variation for all the characters are presented in (table 1) the results are in confirmation to the findings of Deosarkar *et al.,* (1989). PCV was higher than the GCV for 11 character studied, indicating little role of environment on the expression of these characters. Higher heritability was highest in traits viz. number spikelets / panicle (99.87%). High genetic advance observed for number of spikelet / panicle (41.34%) and flag leaf length (41.12%) and low genetic advance observed only for days to maturity (5.07%). Genotypic coefficient of variation (GCV) ranged from 4.49% for days to 50% flowering to 20.08% No. of spikelets/panicle. Higher magnitude of genotypic coefficient of variation was recorded for No. of spikelets/ panicle (20.08%), flag leaf length (19.99%) and grain yield (18.84%). Relatively high differences between genotypic coefficient of variation and phenotypic coefficient of variation were observed for flag leaf width, grain yield per hill, harvest index, number of tiller per hills and days to maturity. These findings suggested that greater influence of the environmental in the expression of these traits. Similar results were also reported by Mohammad *et al.* (2002) that the high magnitudinal difference between phenotypic coefficient of variation and genotypic coefficient of variation for flag leaf width and number of panicle per hills, where as environmental coefficient of variation contributed more in the expression of these characters.

Table1. *Estimation of components of variance and genetic parameters for 11 character in rice germplasm*

Characters	σ^2p	σ^2g	σ^2e	Coefficient of variation		h^2(bs) (%)	GA as (%)
				PCV(%)	GCV(%)		
Days to 50% flowering	21.78	20.92	0.85	4.57	4.49	96.06	9.07
Plant height (cm)	157.78	157.30	0.48	11.54	11.53	99.69	23.71
No. of tillers/ plant	6.43	6.33	0.10	17.67	17.53	98.41	35.83
Flag leaf length	47.40	47.24	0.16	92.03	19.99	99.66	41.12
Flag lead width	0.02	0.02	0.00	11.22	11.14	98.71	22.81
Panicle length	4.14	4.06	0.07	7.91	7.84	98.14	16.00
No. of spikelet's panicle	858.12	856.97	1.15	20.09	20.08	99.87	41.34
Biological yield	159.72	159.50	0.21	17.40	17.38	99.86	35.79
Harvest index	7.93	7.45	0.47	9.23	8.95	93.99	17.88
Grain yield / plant	17.58	17.39	0.18	18.94	18.84	98.94	38.60
Days to maturity	14.35	12.17	2.18	2.90	2.64	84.77	5.07

σ^2g= Genotypic variance, σ^2p = Phenotypic variance, σ^2e Environmental variance, GCV=Genotypic coefficient of variation, PCV= Phenotypic coefficient of variation, h2 (bs)= Heritability broad sense, GA= Genetic advance.

Heritability is a measure of the extent of phenotypic variation caused by the action of genes. It is evident that the heritability (broad sense) was estimated for 11 quantitative characters under study, ranged from 84.77% (days to maturity) to 99.87% (Number of spikelets panicle). Mhandarkar *et al.* (2002) recorded high heritability for plant height. However, Nayak *et al.* (2002), Singh *et al.* (2002), Patil *et al.* (2003), Vivek *et al.* (2004) and Elayaraja *et al.* (2005) registered high estimated of heritability for grain yield per plant. Genetic advance for all the quantitative character under study was ranged from 5.07% (days to maturity) 41.34% (spikelet's/ panicle) high genetic advance was observed spikelet's / panicle (41.34). High heritability along with high genetic advance as percent of mean was registered for grain yield, no. tillers/hill, biological yield, plant height, flag leaf width, harvest index and panicle length suggesting preponderance of additive gene action in the expression of these character. This type of character could be improved by mass selection and breeding methods based on progeny testing. However,

high heritability associated with moderate genetic advance as percent of mean was observed for days to 50% flowering, days to maturity suggesting greater role of non – additive gene action in their inheritance. Therefore heterosis breeding could be used to improve these traits. Correlation coefficient is a statistical measure which is used to find out the degree (strength) and direction of relationship between two or more variable. Seed yield per plant showed positive significant correlation with biological yield (0.8619), harvest index (0.3868), spikelet per panicle (0.1548), plant height (0.1529), number of tiller per plant (0.1390), panicle length (0.1230). Harvest index showed positive significant association with seed yield / plant (0.3868) but the correlation showed non- significant negative association with biological yield (-0.1249) at genotypic level. Biological yield showed positive significant with seed yield per plant (0.8619) at genotypic level.

Table2. *Genotypical correlation Matrix*

S.No	Character	Days to 50% flowering	Plant height (cm)	Tiller /plant	Flag leaf length (cm)	Flag leaf width (cm)	Penicle length (cm)	Spiklets /penicle	Days to maturity	Harvest index	Biological yield	Seed yield /plant (g)
1.	Days to 50% flowering	**1.0000**	0.2929	0.0028	0.2056	0.2360	-0.0652	0.0735	0.9638	-0.2100	-0.0512	-0.1594
2.	Plant height (cm)		**1.0000**	0.0464	0.7540	0.2501	0.1932	0.0570	0.2273	-0.0731	0.2146	0.1529
3.	Tiller per plant			**1.0000**	-0.0301	0.0906	0.1677	0.0976	0.0182	0.1590	0.0684	0.1390
4.	Flag leaf length (cm)				**1.0000**	0.3195	0.0073	-0.0098	0.1401	-0.1472	0.1822	0.0814
5.	Flag leaf width (cm)					**1.0000**	0.0982	0.3323	0.1849	0.0146	0.0207	0.0191
6.	Penicle length (cm)						**1.0000**	0.3140	-0.0371	-0.2335	0.2718	0.1230
7.	Spiklets per penicle							**1.0000**	0.0420	0.0554	0.1231	0.1548
8.	Days to maturity								**1.0000**	-0.2682	-0.0767	-0.2114
9.	Harvest index									**1.0000**	-0.1249	0.3868
10.	Biological yield										**1.0000**	0.8619
11.	Seed yield per plant (g)											**1.0000**

Table3. *Phenotypical Correlation Matrix*

S.No	Character	Days to 50% flowering	Plant height (cm)	Tiller / plant	Flag leaf length (cm)	Flag leaf width (cm)	Penicle length (cm)	Spiklets /penicle	Days to maturity	Harvest index	Biological yield	Seed yield per plant (g)
1.	Days to 50% flowering	**1.0000**	0.2867	0.0017	0.2007	0.2317	-0.0625	0.0714	0.8968	-0.1921	-0.0502	-0.1513
2.	Plant height (cm)		**1.0000**	0.0470	0.7515	0.2495	0.1900	0.0570	0.2117	-0.0716	0.2141	0.1518
3.	Tiller per plant			**1.0000**	-0.0303	0.0907	0.1621	0.0971	0.0126	0.1547	0.0676	0.1376
4.	Flag leaf length (cm)				**1.0000**	0.3165	0.0081	-0.0097	0.1312	-0.1446	0.1815	0.0798
5.	Flag leaf width (cm)					**1.0000**	0.0980	0.3300	0.1736	0.0163	0.0204	0.0209
6.	Penicle length (cm)						**1.0000**	0.3109	-0.0352	-0.2230	0.2688	0.1218
7.	Spiklets per penicle							**1.0000**	0.0380	0.0533	0.1230	0.1540
8.	Days to maturity								**1.0000**	-0.2299	-0.0690	-0.1862
9.	Harvest index									**1.0000**	-0.1214	0.3927
10.	Biological yield										**1.0000**	0.8578
11	Seed yield per plant (g)											**1.0000**

Simultaneous expression of character may be either due to pleiotrophy or genetic linkage. If the relationship is due manifold effect of gene or genes, it is difficult to separate those effect by selecting a particular character. In the present study, genotypic and phenotypic correlation confidents were worked out. In general genotypic correlation were higher in magnitude than the phenotypic correlation coefficient. This indicates that these character are positive governed by additive of gene action and are useful in improvement **Krishnaiah *et al.* (1979).** Negative non – significant correlation was observed between grain yield and days to 50 percent flowering of phenotypic level. Similar results were also reported by **Chaudhary and Das (1998) and Rao and Shrivastava (1999).** From the character association in the present investigation, it was apparent that yielding ability in rice might be improved by selecting plant with higher number of spikelet's per panicle and more flag leaf width due importance should be given for these characters while going for selection.

Hence, the investigation it could be concluded that among the 67 rice genotype evaluated under Allahabad conditions, on the basis of per se performance IR72860-74-1-2-1 genotypes was found to be superior in terms of yield and its attributing character namely. Number of spikelet's/ panicle, flag leaf length, grains yield and number of tiller/plant.

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