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Genetic Studies of Yield Variation in mid duration irrigated rice

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Abstract: *Genetic variability and character association were estimated for ten quantitative characters in 22 mid duration irrigated rice genotypes during kharif 2010.High estimates of heritability coupled with high genetic advance as percent of mean were recorded for most of the characters indicating the presence of additive gene effects in them.The genotypic and phenotypic coefficient of variation were maximum for flag leaf area, grain yield, number of effective tillers per plant , number of fertile grains per panicle,100 seed weight and harvest index indicating selection for such characters would be more reliable.In the present study all the component traits exhibited positive association with grain yields except plant height and panicle length although the level of association varied.Path analysis revealed that number of effective tillers/plant followed by fertile grains/panicle ,100 seed weight and panicle length were the important characters contributing for grain yield.*

Key words: *Irrigated rice, genetic advance, genetic variability, heritability, genetic advance, correlation analysis*

I. Introduction

Rice is the most important staple food crop in the world particularly in South East Asia.The presence and magnitude of genetic variability in a gene pool is the pre-requisite of a breeding programme.The genotypic coefficient of variation indicates the range of variability present in different characters, while the phenotypic coefficient of variation measures the role of environment on the genotypes. Heritability estimates provide the information on the proportion of variation that is transmissible to the progenies in subsequent generations. The grain yield is a complex character ,quantitative in nature and an integrated function of a number of component traits.Therefore, selection for yield per se may not be much rewarding unless other than yield attributing traits are taken into consideration. The present investigation was undertaken to study the different genetic parameters and association of component characters with yield.

II. Materials and Methods

The experiment consisted of twenty two mid duration irrigated rice genotypes including checks was conducted in a Randomized Block Design with three replications at Rice Research Station , OUAT, BBSR during 2010, kharif season.The plot size was 5.4 meter square with a row spacing of 20 cms and plant to plant spacing of 15 cm. The recommended fertilizer dose was 80:40:40 kg of N:P:K per hectare.The recommended crop management practices were followed including need based irrigation and plant protection practices.The observations were recorded in three competitive plants selected randomly from each plot and replication for ten quantitative characters such as days to 50 % flowering , plant height, number of effective tillers per plant, flag leaf area, panicle length, fertile grains per panicle, fertility %, 100 grain weight,harvest index and grain yield per plot. The genotypic coefficient of variation(GCV) and phenotypic coefficient of variation (PCV) were calculated by using the formula given by Burton (1952).Heritability were estimated by using the formula suggested by Lush (1949) and Burton and DE Vane (1953) and genetic advance was also estimated as per the formula suggested by Johnson *et al*.(1955).

III. Results and Discussion

The analysis of variance showed highly significant differences among the test entries for all the characters under study indicating existence of wide genetic variation among the test entries.

Table 1: Composition of entries in mid duration irrigated rices (Kharif, 2010).

Sl.No.	Designation	Cross combination
1	OR 1911-9	Swarna / IR 64
2	OR 1916-19	Lalat/ Ratna
3	OR 1929-4	OR 929-3-2/BP 2423-108-97
4	OR 1946-2	IR 64/ORP 598-7
5	OR 1968-2	Kalakeni/ IR 72
6	OR 1974-4	BAU 125-4-1/IR 64
7	OR 2006-12	Sarathi/ IR 64
8	OR 2055-21	RP 2423-10893/RP 2469
9	OR 2172-7	IR 64///IR 72//Jag/NCJ 10

10	OR 2200-5	RP 2423-10897/ORS 199-2
11	OR 2320-3	OR 650-7//OR 820-38/Lalat
12	OR 2324-25	OR 1206-26-2/IR 57313
13	OR 2325-32	OR 1206-26-2/IR 42221
14	OR 2404-RKP-4	Mahalaxmi/IR 62140
15	ORS 199-5	WGL 48684/Lalat
16	ORJ 7	
17	Lalat	Obs 677/IR 2071//Vikram/W 1263
18	Bhoi	Gouri/ RP 825-45-1-3
19	Sebati	Daya/ IR 36
20	Manaswini	Swarna/Lalat
21	CR 749-20-2	
22	Konark	Lalat/OR 135-3-4

Table 2: Estimation of Mean & Range for various characters

Sl no	Characters	Mean	Range
1.	Days to 50% flowering	105.439	101.00-111.00
2.	Plant height	106.143	87.843-123.04
3.	Panicle length	24.294	21.700-27.610
4.	Flag leaf area (cm^2)	16.756	7.83-24.323
5.	No. of effective tillers/plant	6.864	5.00-9.00
6.	No. of fertile grains/panicle	82.480	66.667-108.667
7.	Fertility %	68.335	56.733-78.667
8.	100 seed weight(gm)	2.107	1.727-2.593
9.	Harvest index	0.339	0.263-0.407
10.	Plot yield (q/ha)	25.726	12.654-38.271

Table 3: Estimation of PCV, GCV, h^2 and GA estimates for various characters.

Sl no.	Characters	PCV	GCV	h^2	GA	GA % over mean
1.	Days to 50% flowering	4.48	4.07	82.56	8.026	7.61
2.	Plant height	8.41	7.80	86.01	15.821	14.91
3.	Panicle length	7.78	6.88	78.10	3.042	12.52
4.	Flag leaf area (cm^2)	30.50	29.03	90.62	9.539	56.93
5.	No. of effective tillers/ plant	20.26	18.50	83.39	2.388	34.80
6.	No. of fertile grains/panicle	14.19	12.30	75.17	18.125	21.97
7.	Fertility %	9.83	8.95	82.89	11.469	16.78
8.	100 seed weight(gm)	13.30	12.08	82.41	0.476	22.58
9.	Harvest index	13.28	12.69	91.38	0.085	24.99
10.	Plot yield (q/ha)	25.38	20.65	66.18	8.903	34.61

The PCV and GCV maintained correspondence for all the characters and both PCV and GCV were high for flag leaf area,grain yield, number of effective tillers per plant,number of fertile grains per panicle,100 seed weight, and harvest index.From the investigation ,it was observed that phenotypic coefficient of variation was found to be higher than that of genotypic coefficient of variation for all the characters.Among all the characters studied,the GCV ranged from 4.07% for days to 50% flowering to 12.3% for number of fertile grains per panicle and PCV ranged from 4.48% for days to 50% flowering to 14.19% for number of fertile grains per panicle. Thus selection based on phenotypic performance of these characters would be effective to bring about considerable improvement in these characters.

High degree of heritability estimates were obtained in case of plant height,flag leaf area and harvest index ranged between 86.01 per cent (plant height) and 90.62 per cent (flag leaf area) and 91.38 per cent (harvest index)(Table 3). Similar results were reported by Yadav (1992) for plant height,sterility, days to 50 % flowering ,harvest index and yield per plant.A moderately value of heritability estimates were recorded for panicle length, number of effective tillers per plant, number of fertile grains per panicle, fertility % and 100 seed weight.Moderately high heritability estimates of traits indicated that these were comparatively more influenced by the environmental factors.

Table 4:. Estimates of phenotypic and genotypic correlation co-efficient among various characters

characters		Days to 50% flowering	Plant height	Panicle length	Flag leaf area (cm^2)	No.of effective tillers/plant	No. of fertile grains/panicle	Fertility %	100 seed weight (gm)	Harvest index
Plant height	r_p	0.500*								
	r_g	0.595**								
Panicle length	r_p	0.421	0.692**							
	r_g	0.431*	0.833**							
Flag leaf area (cm^2)	r_p	0.161	0.137	0.101						
	r_g	0.177	0.117	0.099						
No.of effective tillers/plant	r_p	0.072	-0.368	-0.623	-0.052					
	r_g	0.079	-0.453	-0.753	-0.103					
No. of fertile grains/panicle	r_p	0.521*	0.435*	0.413	0.089	-0.087				
	r_g	0.670**	0.521*	0.552**	0.097	-0.066				
Fertility %	r_p	0.159	0.175	-0.374	-0.025	0.401	0.191			
	r_g	0.204	0.206	-0.384	-0.035	0.468*	0.198			
100 seed weight (gm)	r_p	-0.041	0.060	-0.091	0.225	-0.163	-0.458	0.205		
	r_g	-0.033	0.044	-0.172	0.259	-0.160	-0.582	0.296		
Harvest index	r_p	-0.127	0.099	-0.251	0.164	0.388	-0.395	0.316	0.318	
	r_g	-0.164	0.102	-0.269	0.181	0.469*	-0.494	0.299	0.416	
Plot yield (q/ha)	r_p	0.096	-0.123	-0.388	0.044	0.721**	0.478**	0.555**	0.134	0.369
	r_g	0.139	-0.183	-0.591	0.040	0.971**	0.641**	0.734**	0.081	0.427*

* Significant at 5% level
** Significant at 1% level

High genetic advance was observed for the characters namely flag leaf area, number of effective tillers per plant, plot yield and it was moderate to low for rest of the characters.High estimates of heritability coupled with high genetic advances were observed for the characters i,e plant height, number of fertile grains per panicle and fertility % indicating the predominance of additive gene action. On the other hand, flag leaf area, panicle length, number of effective tillers per plant, grain yield, 100 seed weight showed high heritability with low genetic advances revealing the preponderance of non additive gene action.

In the present investigation, the estimates of genotypic correlation were higher than that of phenotypic correlation indicating that the environmental causes of correlation had affected the genetic cause, there by reducing the reliability of phenotypic correlation for use in crop improvement programme. Highest estimates of correlation both at genotypic and phenotypic level was between yield and number of effective tillers / plant (r_p = 0.721; r_g = 0.971). It was followed by number of fertile grains/panicle (r_p =0.478; r_g=0.461), fertility % (r_p =0.555; r_g =0.734), harvest index (r_p=0.369; r_g=0.427). The rest of the characters had non-significant correlation with yield.

The result revealed that days to 50% flowering had significant positive correlation with plant height, panicle length and number of fertile grains per panicle. The plant height had positive significant correlation with panicle length, number of fertile grains per panicle. The panicle length showed positive correlation with number of fertile grains per panicle. The number of effective tillers per plant exhibited positive significant correlation with fertility % and harvest index.

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