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Genotypic and Phenotypic Condition Coefficient Analysis for Yield and Yield Related Components in Basmati Rice (*Oryza sativa* L.)

[1]Muhammad Saleem Akhter, [1]Muhammad Rizwan, [1]Muhammad Akhter,
[2]Muhammad Naeem, [1]Waqas Hussain, [4]Farrukh Elahi and [3]Muhammad Latif

[1]Rice Research Institute Kala Shah Kaku, Punjab, Pakistan
[2]Department of Plant Breeding and Genetics, UCA& ES TheIslamia University of Bahawalpur, Pakistan
[3]Department of Agronomy , UCA & ES, The Islamia University of Bahawalpur, Pakistan
[4]Cotton Research Institute, AARI, Faisalabad, Pakistan

Abstract: Paddy yield is an intricate character and depends upon different factors called yield components. To study the correlation between yield and its components, an experiment comprising thirteen fine grain genotypes including two check varieties was conducted at Rice Research Institute, Kala Shah Kaku. The results revealed that phenotypic correlations were generally lower than their respective genotypic correlations. Plant height expressed significant, but negative genotypic and phenotypic measures of correlation with paddy yield and number of tillers. Number of tillers per plant exhibit extremely significant phenotypic correlation and significant positive genotypic correlation with 1000 grains weight, kernels per panicle, panicle length and yield. Panicle length expressed significant genotypic correlation with 1000 kernels weight, grains per panicle and yield. It was also showed positive significant phenotypic correlation with number of grains per panicle and highly significant positive phenotypic correlation with yield and 1000 grains weight. Grains per panicle are positively and significantly correlated with 1000 grains weight and yield. Genotypic and phenotypic correlation between paddy yield and 1000 grains weight were found positively significant and highly significant respectively. Phenotypic correlation of variability was higher than their respective genotypic coefficients for all parameters.

Key words: *Oryza sativa* L. · Phenotypes · Variability · Correlation

INTRODUCTION

Rice (*Orayza sativa* L.) is the staple food of teeming millions of world. In Pakistan, rice not only provides sustenance to our population, but the fine quality rice also plays an important role in the economy of Pakistan as an export item. “Kallar Tract” in Pakistan is a blessing of God which is the best place in the world for production of aromatic rice. For increasing paddy yield, correlation study between yield components of fine rice will be useful to enhance the selection of high yielding lines / varieties. Extensive studies have been made in this regard. It was concluded that there was significant and positive correlation among 1000 grains weight and paddy yield [1]. It was studied that the significant positive phenotypic correlation was presentamong grain yield and seeds per panicle [2]. It was also concluded that grain yield per plant was significantly correlated with grains per panicle and 1000 grains weight [3]. Correlation between rice yield and yield components was studied by [4]. He concluded that the 1000 grains weight and number of grains per panicle had direct effect on yield. It was reported that in semi tall varieties of rice, grain yield has a positive correlation with plant height at maturity [5]. It was reported that1000 grains weight and number of grains per panicle has positive genotypic and phenotypic correlation with grain yield [6]. The conclusion was verified by Bhatti, [7], Baber, [6] and Prasad, [8]. The present study with 13 promising lines was carried out for computing the correlation between six quantitative traits. This study will be helpful for the development of new varieties.

Corresponding Author: Muhammad Naeem, Department of Plant Breeding and Genetics, UCA& ES TheIslamia University of Bahawalpur, Pakistan.

MATERIALS AND METHODS

The study was conducted at Kala Shah Kaku Rice Research Institute, during Kharif 2009-2010. The nursery of 12 genotypes 00515, 00512, 99404, 00518-1, PK8337-2-2-1, 99316, PSI, Jajai 25/A, DM1-30-34-94, EF1-20-119-02, T5, T15 along with one standard variety Super Basmati was sown on 20-05-2009. Thirty days nursery was transplanted into field in RCBD with three replications. The plots size for each treatment was 3 × 5m. All standard agronomic practices were adopted.Data on 10 plants from each replicate was recorded on i) number of tillers per plant ii) panicle length (cm) iii) plant height (cm) iv) 1000 grains weight (g) v) number of grains per panicle, vi) paddy yield (t/ha). The data thus collected was subjected to analysis of variance and co-variance.Genotypic and phenotypic variance and coefficients of variance, heritability, genetic advance and genotypic correlation coefficient were calculated through the formula suggested by Singh, [9].

RESULTS AND DISCUSSION

All the genotypes showed highly significant differences at $P \leq 0.01$ for each and every onetrait (Table 1).

Both genetic and phenotypic variances, heritability, phenotypic coefficient of variation (PVC), genotypic coefficient of variation (GCV) and genetic advance (% age of mean) of six economic characters of thirteen fine grain genotypes were calculated (Table 2). Genotypic and phenotypic coefficient of variability showed that phenotypic coefficients of variability were higher than the respective genotypic coefficients of variability which might be the result of influence of environment on the development of characters period. The GCV ranged from 9.30 to 36.86. The maximum genotypic variability exhibited by the paddy yield (36.86%) followed by the number of tillers per plant (31.81%). Plant height showed the maximum consistency in performance as it has the least value of GCV (9.30%). Genotypic and phenotypic correlation coefficients in all possible combinations are shown in Table 3. The data in Table 3 showed that genotypic correlation coefficients were greater than the respective phenotypic ones, indicating a fairly strong inherent interrelationship among traits [10]. Plant height exhibited the negative correlation with number of tillers per plant and paddy yield. The results presented are in accordance with Tahir, [11] and Zahid, [12]. Negative phenotypic and genotypic correlation amongkernel yield and plant height was reported by Amirhadevarathinam, [13]. Highly significant negative correlation among plant height and paddy yield was reported by Mehetre, [14]. Number of tillers per plant were positively and significantly genotypically while highly significantly phenotypically correlated with number of tillers for every plant, panicle length, number of kernel for each panicle, 1000 grains weight and paddy yield. Same correlation among number of tillers per plant and paddy yield was reported by Latif, [10]. Positive significant phenotypic correlation of number of tillers per plant with paddy yield was showed by Bhatti, [7]. Panicle length was significantly positively correlated with number of grains per plant, 1000 grains weight and yield and a highly significant correlation was found on phenotypic basis with 1000 grain weight and paddy yield.

Table 1: Means squares for analysis of variance for economic traits in fine quality rice

Source of variation	DF	Height	Tillers/ plant	Panicle length	Grains/ panicle	1000 grains weight	Yield
Replication	2	47.490	1.615	4.803	14.769	0.244	
Genotype	12	440.105**	70.799**	75.551**	2088.842**	28.882**	60.437**
Error	24	22.079	4.588	2.651	74.214	0.493	5.040

**Significant ($P \leq 0.01$)

Table 2: Genetic parameters for yield and yield related components in fine quality rice (*Oryza sativa* L.)

			Variance		Coefficient of variability (CV% age)			
Traits	Trait mean	Range	Genotypic	Phenotypic	Genotypic	Phenotypic	Heritability	GA(1%)
Plant height	126.91	112.33 -153.73	139.34	161.42	9.30	10.01	0.86	19.25
Tillers / plant	14.77	7.67 -24.33	22.07	26.66	31.81	34.96	0.83	7.50
Panicle length	28.34	16.33 – 33.22	24.30	26.95	17.39	18.32	0.90	8.22
No. of grains / panicle	131.07	104.33 – 175.33	671.54	745.76	19.77	20.83	0.90	43.16
1000 grains weight	23.08	18.53-27.49	9.46	9.96	13.33	13.67	0.95	5.26
Yield	11.65	4.84-18.10	18.46	23.51	36.86	41.58	0.79	6.68

Table 3: Genotypic (rg) and phenotypic (rp) correlation coefficients among six morpho-agronomic characters of rice (*Oryza sativa* L.)

Characters	No. of tillers / plant	Panicle length (cm)	No. of grains / panicle	1000 grains weight (g)	Paddy yield per plant (g)
Plant height (cm) r(g) r(p)	-0.47879*	-0.33307	-0.16432	-0.31346	-0.5218*
	-0.46971*	-0.28152	-0.18582	-0.29732	-0.43612*
Number of tillers/plant r(g) r(p)	1	0.627731*	0.645671*	0.921459*	0.972827*
	1	0.586876**	0.580674**	0.822121**	0.785138**
Panicle length (cm) r(g) r(p)		1	0.49398*	0.712444*	0.743655*
		1	0.456748*	0.671053**	0.614641**
No. of grains/panicle r(g) r(p)			1	0.810031*	0.766995*
			1	0.757393**	0.647214**
1000 grains weight (g) r(g) r(p)				1	0.957713*
				1	0.809861**
Paddy yield /plant(g) r(g) r(p)					1
					1

* $P \leq 0.05$, ** $P \leq 0.01$

Same result regarding panicle length and number of grains per panicle was reported by Chaudhry, [1]. Number of grains per panicle showed positive genotypic correlation with 1000 grain weight. Number of grains per panicle and 1000 grains weight showed significantly positive correlation with yield on genotypic and phenotypic basis [7, 10, 8, 15]. Plant height have negative correlation with paddy yield while number of tillers for each plant, panicle length, No. of grains for each panicle and 1000 grain weight have the highest correlation coefficient with yield.

CONCLUSION

For the development of high yielding variety, genotypic preference might be given to number of tillers per plant, panicle length, 1000 grains weight, number of grains per panicle and paddy yield.

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