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Genetic analysis and character association in F_2 generation of ric

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Abstract : F_2 generations of 21 crosses were evaluated for the genetic parameters as well as association of certain yield components in rice. The phenotypic and genotypic coefficients of variation were high for productive tillers/plant and 100-grain weight. These two traits, besides filled grain/panicle also registered high heritability (narrow sense) coupled with high genetic advance. Among the yield components, productive tillers/plant and 100-grain weight had significant correlation with grain yield/plant, in addition to exhibiting direct positive effects on it. For increasing yield potential, selection would be more effective when aimed at isolation of purelines with high number of productive tillers per plant coupled with high test weight grains.

Key Words : Rice, F_2 generation, Genetic parameters.

Introduction

Rice is one of the most important cereal crops of the world by meeting the dietary requirements of the people living in the tropics and sub-tropics. In view of the growing population, the basic objective of the plant breeders would always be towards yield improvement in staple food crops. In the recent years, much emphasis is being given for commercial exploitation of heterosis in rice through cultivation of hybrid varieties across the country. Nevertheless, most of the rice growing area, at present, is under straight varieties, as the seed production of these cultivars is easy and can be produced at lesser cost at farmers level. Therefore, there is a need to pay immediate attention for raising present yield ceiling in straight varieties too, which are widely adopted with high tolerance to biotic and abiotic stresses besides possessing good grain quality characteristics.

To achieve genetic improvement in yield traits, it is imperative to generate information on variability, its heritable proportion and also interrelationships existing there in the breeding material handled. The F_2 generation is critical for success of the breeding programme, as there are remote chances of recovering superior recombinants in advanced generations, if proper selection is not exercised to spot out useful segregants in F_2. The present investigation wa undertaken with 21 F_2 populations to stud various genetic parameters so as to formulat effective selection criteria to isolate high yiel potential pure lines of rice.

Materials and Methods

Seven parents (IR-20, Shiva, Tellahamsa, Lunisree, WGL-NDL-2, Erramallelu and RDR-763) selected on the basis of genetic divergence study conducted during *kharif* 1998 were crossed in a diallel fashion (7x7) without reciprocals during *rabi* 1998-99. The resultant F_1s were advanced to F_2 during *kharif* 1999 season.

The final experiment was laid out with F_2s of 21 crosses and their 7 parents at Agricultural Research Station, Warangal during *rabi* 99/2000 (post rainy season) in a Randomized Block Design with 3 replications. Recommended package of practices including a fertilizer dose of 100 N, 60 P_2O_5 and 40 K_2O Kg/ha were followed as specified for transplanted rice. Each entry was grown in 5 rows of 3 m length adopting a spacing of 20 x 15 cm with single seedling per hill. Observations were recorded on yield components and physical grain characteristics such as days to 50% flowering, productive tillers per plant, plant height (cm), panicle length (cm), filled grains per panicle, 100-

Table 1. Genetic parameters for yield and physical grain quality characters in F_2 progeny

Sl. No.	Parameter	Days to 50% flowering	Productive tillers/ plant	Plant height	Panicle length	Filled grains/ panicle	100 grain weight	Grain yield/ plant	Kernel length	Kernel breadth	Length/ breadth ratio
1.	PCV (%)	6.49	16.10	12.60	4.08	13.04	16.13	12.75	7.55	5.81	5.92
2.	GCV (%)	6.45	15.75	12.34	3.86	12.88	16.09	12.32	7.52	5.76	5.86
3.	h^2 (Narrow sense in percentage)	53.01	59.60	64.61	72.54	71.12	97.6	48.05	96.05	79.10	80.14
4.	GA (%)	12.73	3.95	22.07	1.68	35.65	0.65	5.37	0.96	0.24	0.36
5.	GAM (%)	13.20	31.76	24.91	7.52	26.20	33.09	24.53	15.43	11.78	11.96

grain weight (g), grain yield per plant (g), kernel length (mm), kernel breadth (mm) and kernel length/breadth ratio and the means were subjected to statistical analysis. Finally, the parameters Genotypic and Phenotypic coefficients of variation (Burton, 1952), Heritability in narrow sense, Genetic advance, Genetic advance as percentage of mean (Johnson *et al.* 1955), Simple Correlations (Panse and Sukhatme, 1985) and path analysis (Dewey and Lu, 1959) were estimated.

Results and Discussion

The genetic parameters are presented in Table 1. The Phenotypic Coefficient of Variation (PCV) was higher than Genotypic Coefficient of Variation (GCV) for all the characters and the difference between these two was observed to be low for grain quality characters, which indicated less influence of environment on them. In comparison, higher GCV and PCV values were associated with productive tillers per plant and 100-grain weight and low variability was observed for days to 50% flowering, as was reported earlier by Ganeshan *et al.* (1996). Moderate to high heritability coupled with low genetic advances as percent of mean (Ganeshan and Subramanian, 1994) for this trait indicated limited scope of improvement through selection.

Higher grain yield is the prime objective in any breeding programme, and the progress in this direction demands effective selection on yield determining attributes with high heritability and genetic advance. Heritability when estimated in narrow sense, gives the additive variance, which is fixable in nature through simple selection procedures. In the present investigation, among the yield components studied, productive tillers per plant and 100 grain weight recorded moderate and high heritability respectively, in addition to the highest genetic advance as percent of mean as was reported earlier by Marimuthu *et al.* (1990) and Reddy and Nerkar (1991). This concluded that their inheritance was under the influence of additive gene action. As such, selection for improvement of these two components would be highly rewarding. On the other hand, chances of improvement through panicle length are meagre due to its lowest variability and genetic advance, although heritability estimates were high (Sardhana and Borthakur, 1987).

High heritability coupled with high to moderate genetic advance as per cent of mean registered in case of kernel length and L/B ratio indicated success through single plant selections in early segregating generations due to prevalence of additive gene action (Chauhan, 1996).

Table 2. Estimates of simple correlation coefficients for yield characters in F_2 progenies

Character	Days to 50% flowering	Plant height	Productive tillers/ plant	Panicle length	Filled grains/ panicle	100 grain weight	Grain yield/ plant
Days to 50% flowering	1.0000	0.0622	-0.2161	0.3224	-0.2285	0.2220	0.0722
Plant height		1.0000	-0.0092	0.3779	-0.3334	0.7895**	0.6254**
Productive tillers/plant			1.0000	-0.6371**	-0.2614	-0.0146	0.5873**
Panicle length				1.0000	0.0851	0.3744	-0.0574
Filled grains/panicle					1.0000	-0.6244**	-0.2854
100-grain weight						1.0000	0.5313**

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

Table 3. Estimates of direct and indirect effects of yield characters in F_2 progenies

Character	Days to 50% flowering	Plant height	Productive tillers/ plant	Panicle length	Filled grains/ panicle	100 grain weight
Days to 50% flowering	0.1902	0.0118	-0.0411	0.0613	-0.0435	-0.0422
Plant height	0.0292	0.4693	-0.0043	0.1773	-0.1565	0.3705
Productive tillers/plant	-0.1592	-0.0068	0.7369	-0.4694	-0.1926	-0.0107
Panicle length	0.0125	0.0146	-0.0247	0.0387	0.0033	0.0145
Filled grains/panicle	-0.0657	-0.0959	-0.0752	0.0245	0.2876	-0.1796
100-grain weight	0.0654	0.2324	-0.0043	0.1102	-0.1838	0.2944
Correlation with yield	0.0722	0.6254	0.5873	-0.0574	-0.2854	-0.5313

Residual effect = 0.4336

Study of simple correlations indicated that plant height, productive tillers per plant and 100-grain weight had significant correlation with grain yield per plant (Table 2). These results are in conformity with the findings of Verma and Mani (1998), Surek *et al.* (1998) and Venkatramana *et al.* (1999) for productive tillers and 100-grain weight and Basavaraja *et al.* (1997) and Mishra (1999) for plant height. There was no correlation between days to flowering and grain yield (Surek *et al.* 1998). Grain yield had negative correlation with filled grains per panicle as was reported earlier by Rao and jagadish (1987). High positive direct effects on grain yield were exhibited by productive tillers/plant, plant height and moderate direct effects by 100-grain weight and filled grains/ panicle (Table 3).

In the present study, productive tillers/ plant and 100-grain weight exhibited moderate to high heritability coupled with high genet advance as percentage of mean. Interestingl these two components also had positive significa correlation with grain yield besides exertir positive direct effects on it. Therefore, th improvement of yield is straight forward, the selection is based on these two yield attribute in segregating populations and the best specif crosses identified for simultaneous improveme of yield and quality in the material were Lunisre RDR-763, WGL-NDL-2/Erramallelu, Erramallel RDR-763, Shiva/Lunisree and Tellahamsa/Lunisre

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