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Studies on Genetic Variability for Grain Yield Related Traits, Iron and Zinc Content in RIL Population of Rice (*Oryza sativa* L.)

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ABSTRACT

Genetic variability was studied in F_7 RIL population of the cross IR 64 X Jalpriya of rice at Indian Institute of Rice Research farm, ICRISAT, Hyderabad, India, during kharif, 2017 to estimate variability for grain yield and yield attributing characters along with grain iron and grain zinc concentrations. The results showed that PCV values in general were higher than GCV for various characters studied. The phenotypic and genotypic co-efficient of variation (PCV and GCV) was high for grain yield per plant followed by number of productive tillers per plant, number of filled grains per panicle and moderate for plant height, panicle weight and grain iron concentration. The small difference observed between GCV and PCV indicate the presence of high genetic variability for the traits which may facilitate selection. High heritability coupled with high GAM was found for the traits viz., plant height, number of productive tiller per plant, number of filled grains per panicle and single plant yield indicate that these characters are attributable to additive gene effects which are fixable and revealed that improvement in these characters would be possible through direct selection.

Key words: *Rice, Yield, Crop, RIL, Food*

INTRODUCTION

Rice is the world's most important food crop. Rice (*Oryza sativa* L.) is the staple food for 65% of the global population and forms the cheapest source of food, energy and protein[9]. It is a model cereal species occupies the enviable prime place among the food crops cultivated around the world. India is the second largest producer of rice next to China producing 104.92 m t from an area of 43.5 m ha. In Telangana, rice is cultivated in 17 Lakh hectares with a production of 64 lakh metric tonnes with an average productivity of 3685 kg ha$^{-1.}$ "Rice is life" suits the most for Indian culture, as this crop plays a livelihood for millions of rural households and describes its importance in food and nutritional security. Producing nutritious and safe foods sufficiently and sustainably is the ultimate goal of modern agriculture. Past efforts were focussed on increasing crop yields, but enhancing the concentrations of mineral micronutrients has become an urgent task.

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Therefore, the present study has been undertaken to determine the estimates of variability, heritability and genetic advance as per cent of mean for grain yield and its component traits in F_7 RIL population.

MATERIAL AND METHODS

The present investigation was carried out during kharif 2017-18 at Indian Institute of Rice Research Farm, ICRISAT, Hyderabad, India. The experimental material consisted of selected F_7 RILs of cross (IR 64 X JALPRIYA). Hundred selected RIL's along with four checks containing high Iron and Zinc were sown in four blocks. This RILs were evaluated in Augmented Randomised Block Design. Twenty five days old seedling of each genotypes were transplanted in three rows of 2.0 m length by adopting a spacing of 20 cm between rows and 15 cm between plants, with in the rows at the rate of 25 plants per row. The crop was grown with the application of fertilizers, N, P and K at the rate of 120:60:40 kg/ha respectively. Standard agronomic practices were followed to raise a good crop. A composite sample of 5 plants from the middle row was used to record observation on these plants for plant height, number of productive tillers per plant, panicle length, number of filled grains per panicle, test weight, yield per plant, except days to 50% flowering which was randomly five plants were selected and observations were recorded.

Grain iron and zinc concentration were determined by X – Ray fluorescence Spectrometry (XRF) (EDXRF, model- X-supreme 8000). In XRF the preselected wavelength of incident X – rays expel the electrons from the inner most orbit followed by the transfer of one of the electrons from the outermost orbit to the inner most orbit leading to release of specific wavelength of X – rays. The energy of the emitted radiation is specific for a particular atom. Therefore, it is simultaneously identified and quantified by the detector. This instrument is quite useful in non – destructive determination of relative iron and zinc concentrations in rice samples with more ease.

The data was analysed using WINDOSTAT software programme. The data was recorded on F_7 RIL population. The characters were subjected to statistical analysis as per Federer[4] was recorded in order to assess the variance components, genetic coefficient of variation, phenotypic coefficient of variation and broad sense heritability among genotypes were determined as suggested by Burton and De Vane[1] and Johnson *et al.*,[5].

RESULTS AND DISCUSSION

Genetic variability in any crop is pre requisite for selection of superior genotypes over the existing cultivars. Analysis of variance for grain yield, yield attributing traits, grain iron and grain zinc concentration were presented in table.1.

Estimates of variability, heritability, genetic advance and genetic advance as percent of mean in RIL population were presented in table.2.

In the present investigation, the genotypic and phenotypic coefficients of variation were low for days to 50% flowering and panicle length. Similar results were reported by Devi *et al.*[2] for days to 50% flowering and Singh *et al.*[10] for panicle length. The moderate GCV and PCV values observed for the trait plant height, 1000 grain weight and panicle weight. Similar results were reported by Bhinda *et al*. for plant height, Mamata *et al.*[7] for panicle weight and Devi *et al.*[2] for 1000 grain weight.

The high GCV and PCV was observed for number of filled grains per panicle, number of productive tillers per plant, grain yield per plant. Similar findings were reported by Mamata *et al.*[7] for number of productive tillers per plant, Mahanta *et al*. for number of filled grains per panicle and Umesh *et al.*[11] for grain yield per plant.

The heritability estimates were high for all the traits viz., days to 50% flowering, plant height, panicle length, number of productive tillers per plant, panicle weight, number of filled grains per panicle, 1000-grain weight, grain yield per plant, and grain zinc concentration. These are in conformity with Singh *et al*.[10] for days to 50% flowering, plant height and number of filled grains per panicle, Devi *et al*.[2] for number of productive tillers per plant, 1000-grain weight and grain yield per plant, Dhurai *et al*.[3] for panicle weight. High heritability for quantitative characters indicates the scope of genetic improvement of these characters through selection.

Genetic advance was high for the traits plant height, number of productive tillers per plant and number of filled grains per panicle whereas low for the traits panicle length, panicle weight, 1000-grain weight, grain iron concentration and grain zinc concentration where as moderate for days to 50% flowering and grain yield per plant. Similar results were reported by Devi *et al*.[2] for days to 50% flowering and grain yield per plant, Singh *et al*.[10] for plant height, number of productive tillers per plant and number of filled grains per panicle. High heritability with high genetic advance indicates the control of additive gene and selection may be effective for those characters.

Genetic advance as percent of mean was high for plant height, number of productive tillers per plant, panicle weight, number of filled grains per panicle, grain yield per plant. These results are in conformity with Mohanty *et al*.[8] for plant height, number of filled grains per panicle and grain yield per plant, Singh *et al*. for days to 50% flowering and panicle weight.

The proportion of genetic variability which is transmitted from parents to offspring is reflected by heritability. Heritability estimates indicate effectiveness of selection for phenotypic performance but it is alone not enough to make sufficient improvement through selection. The high heritability estimates coupled with high genetic advance is more useful for the selection. High GCV and PCV values coupled with high heritability and high genetic advance over mean recorded for the traits such as number of productive tillers per plant and grain yield per plant suggesting availability of sufficient variability and thus exhibited scope for genetic improvement through selection for all these traits. These indicates predominance of additive gene action in the inheritance of these traits selection may be effective in early generations for these traits.

Table 1: Analysis of variance for yield and its contributing traits in F_7 RIL population

	DF	DFF	PH	PL	NPT	PW	NFG	TW	SPY	IRON	ZINC
Block (ignoring treatments)	3	45.52**	627.86**	0.23	406.12**	2.80**	2965.51**	15.98**	273.47**	2.99	10.07**
Treatment(ignoring	103	57.52**	579.24**	4.66**	458.88**	0.51**	1304.35**	5.48**	25.74**	5.75*	85.96**
blocks)	3	30.16**	752.32**	3.54*	0.36	1.66**	1078.10**	16.07**	37.55**	38.44**	72.09**
Checks	99	58.84**	499.57**	2.45*	488.89**	0.56**	823.15**	4.96*	32.58**	2.48	4.68**
Varieties	1	56.84**	9828.17**	224.62**	79.78**	0.08**	58423.48**	68.87**	129.78**	235.75**	8193.69**
Checks vs varieties	9	3.88	4.76	0.73	0.49	0.10	31.41	1.16	0.82	1.33	0.43
Error											

* Significance at p = 0.01 **Significance at p = 0.05

DFF = Days to 50 percent flowering

PH = Plant height (cm)

PL = Panicle length (cm)

NPT = Number productive tillers per plant

PW = Panicle weight (g)

NFG = Number of filled grains per panicle

TW = Test weight (g)

SPY = Single plant yield

Table 2: Estimates of variability, heritability, genetic advance and genetic advance as per cent of mean in RIL population

S.NO	CHARACTER	GENERAL MEAN	RANGE		PCV (%)	GCV (%)	h^2	Genetic Advance Percent (at5%)	GA as percent of mean (at 5%)
			Minimum	Maximum					
1.	Days to 50% flowering	108.55	99	124	6.69	6.44	92.59	13.81	12.76
2.	Plant height (cm)	133.62	87.8	174.2	15.3	15.22	98.92	42.84	31.19
3.	Panicle length (cm)	28.55	23.4	34.8	5.16	4.23	67.28	2.08	7.15
4.	Number of productive tillers	11.06	9.4	13.4	156.54	156.45	99.89	42.77	322.12
5.	Panicle weight (g)	3.92	2.77	5.83	18.27	16.38	80.44	1.81	30.27
6.	Number of filled grains per panicle	90.64	12.33	161.33	33.08	32.36	95.70	53.31	65.23
7.	Test weight (g)	21.29	16.33	25.33	9.83	8.47	74.25	3.25	15.04
8.	Single plant yeild	19.53	11.10	33.97	27.0	26.61	97.15	10.75	54.04
9.	Iron concentration (ppm)	8.88	5.9	15.8	18.55	12.19	43.20	1.36	16.51
10.	Zinc concentration (ppm)	22.03	15.3	38.7	10.34	9.79	89.67	3.78	19.11

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