The Andhra Agric. J 62(4):793-797, 2015

Studies on Genetic variability, Heritability and Genetic advance in Rice (*Oryza sativa* L.)

M Venkata Lakshmi, Y Suneetha, A Appalaswamy and N Venkata Lakshmi
Department of Genetics and Plant Breeding, Agricultural college, Naira, Srikakulam 532 185

ABSTRACT

Seventy genotypes of rice (*Oryza sativa* L.) were evaluated for grain yield, yield components and quality traits during *Kharif* 2012 at College farm, Agricultural College, Naira, Srikakulam. The study revealed considerable genetic variability among the genotypes for all the traits. Genotypic and phenotypic coefficients of variation were more or less similar for all the characters. Phenotypic and genotypic coefficients of variation were high for grain yield per plant. High heritability coupled with high expected genetic advance was observed for grain yield per plant, number of grains per panicle, number of effective tillers per plant, plant height, 1000-grain weight, kernel breadth and length breadth ratio revealed the preponderance of additive gene effects in the expression of these traits. High estimate of heritability with low to moderate genetic advance observed for panicle length, days to 50 per cent flowering and kernel length on the other hand revealed the importance of dominance and epistatic effects in the inheritance of these traits.

Key words : Genetic advance,Genetic variability, Heritability, Rice.

Rice is the major staple food crop for majority of global population. Yield and quality enhancement are the major breeding objectives in rice improvement programmes. An evaluation of heritability, genetic advance and the extent of genetic variation available for yield attributes would be of immense help to the breeders as the success of selection in any crop improvement programme is determined by these specific genetic parameters. Further, the knowledge on nature and magnitude of variability is of utmost importance. Keeping this in view, the present investigation was undertaken to assess the variation, heritability and genetic advance in rice.

MATERIAL AND METHODS

The present investigation comprised of 70 genetically diverse genotypes of rice (*Oryza sativa* L.) procured from different sources (Table 1). The experiment was carried out at College farm, Agricultural college, Naira, Srikakulam, located at 18^0 23' North and 83^0 57' East longitude at an altitude of 27m above mean sea level, during *kharif* 2012. The experimental trial was laid out in Randomized Block design with three replications under irrigated conditions. Each plot comprised of two rows of 4 meter length spaced 20 cm apart with plant to plant spacing of 15 cm.

Data on the basis of five randomly taken competitive plants excluding borders were recorded on grain yield per plant (g), plant height (cm), number of effective tillers per plant, panicle length (cm), number of grains per panicle, 1000-grain weight (g), kernel length (mm), kernel breadth (mm) and L/B ratio while days to 50 per cent flowering and days to maturity were recorded on plot basis. The analysis was done as per Panse and Sukhatme (1985), Burton and Devane (1953) and Johnson *et al*. (1955).

RESULTS AND DISCUSSION

Analysis of variance revealed significant differences among the genotypes for all the characters studied (Table 2). The results on mean and range for different characters studied in the present investigation (Table 3) also revealed wide variability among the genotypes studied for different characters. The grain yield per plant ranged from 8.36 g (CAUR-4) to 42.73 g (CR 2986-2-3-1-1-1) with a general mean value of 21.20 g, while days

Table 1. List of genotypes studied in the present investigation.

S.No	Genotype	S.No	Genotype
1	RNR 2781	36	Pusa 5001-8-3-4
2	CB 07-103	37	OR 2345-19
3	OM 5637	38	ORM 400-2
4	MTU 1150	39	ORR-3
5	MTU 1151	40	CAUR-4
6	MTU 1152	41	AD 07244
7	MTU 1112	42	R 1521-880-1-37-1
8	Swarna (NC)	43	KHP-11
9	BPT 2495	44	BKBM-23
10	BPT 2575	45	RNR 6378
11	BPT 2574	46	CR 2655-18
12	CN 1770-9	47	CR 2711-149
13	CR 2702-194	48	CR 2647-5
14	CR 2702-11-8	49	CR 2990-77-6
15	Pooja	50	CR 2942-112
16	CR 2683-5-3-2-1-1	51	CR 2942-68
17	CR 2985-1-2-1-1-1	52	CN 1324-913-303-BNKR-11-1-1
18	CR 2986-2-3-1-1-1	53	CN 1324-913-303-BNKR-11-1-2
19	CR 29881-2-1-1-1	54	CN 1477-19-5-3
20	CR 2985-2-1-3-1-1	55	CN 1476-817-8-19-8
21	RP 5214-38-14-9-5-2-1-B	56	OR 2346-8
22	RP 5214-57-26-9-6-3-2-B	57	OR 2325-12
23	IR 63429-23-1-3-3	58	OR 2989-15-5
24	IR 70153-13-TTB 3-1-3-3	59	RGL 7003
25	RAU 678-82-4	60	RGL 7004
26	29P 34	61	PAU 3698-1-6-6-1
27	29P 36	62	PAU 3739-3-3-1-2
28	XR 99986(29P 38)	63	RP BIO 4919-194
29	XR 99990	64	RP BIO 4919-363-12
30	CB 09 153	65	RGL 11414 (Check)
31	NP 5031	66	RGL 1566
32	NP 6565	67	RGL 1763
33	PAN 804	68	RGL 1786
34	CN 1406-10-2-2	69	RGL 1804
35	Pusa 5001-7-3-3	70	RGL 2225

to 50 per cent flowering ranged from 98.00 (PAU 3698-1-6-6-1) to 141.00 (RGL 1566 and RGL 1763) with a mean of 105.88. Further, number of days taken to maturity ranged from 137.33 (MTU 1112) to 164.00 (CR 2702-11-8, CR 2986-2-3-1-1-1, CR 29881-2-1-1-1, AD 07244, RGL 1566, RGL 1763, RGL 1786 and RGL 1804) days with a mean of 147.91, while the mean values for productive tillers per plant ranged from 4.60 tillers (OR 2325-12) to 11.40 (CR 2942-112) with a general mean of 7.82.

Plant height ranged from 96.30 cm (CR 2942-112) to 189.13 cm (BKBM-23) with a general mean of 135.87 cm in height, while the general mean of the panicle length was 27.61 cm with a minimum of 20.63 cm (CR 2942-112) and maximum of 32.20 cm (RGL 7004 and RGL 1763). The mean values for number of grains per panicle ranged from 150.04 (BPT 2574) to 325.75 (BPT 2575) with a general mean of 210.03. In addition, the general mean of 1000 grain weight was 23.56

Table 2. Analysis of variance for grain yield, its components and quality traits in 70 rice genotypes.

Source	Degrees of freedom	Days to 50 per cent flowering	Days to maturity	Number of productive tillers per plant	Plant height	Panicle length	Number of grains per panicle	1000-grain weight	Grain yield per plant	Kernel length	Kernel breadth	L/B ratio
Replications	2	8.31	104.80	1.48	83.61	5.27	116.63	5.33	7.68	0.011	0.005	0.014
Treatments	69	230.86**	220.96**	3.37**	976.01**	18.28**	3931.46**	43.35**	93.36**	0.96**	0.35**	0.66**
Error	138	12.57	30.59	0.39	18.43	2.36	41.40	3.19	3.03	0.007	0.003	0.009

*Significant at 5 per cent level; **Significant at 1 per cent level

Table 3. Variability parameters for grain yield, yield components and quality parameters in 70 rice genotypes (*Oryza sativa* L.).

Characters	Mean	SE ±	Range		PCV (%)	GCV (%)	h^2 (bs) (%)	GA (% of mean)
			Min	Max				
Grain yield per plant	21.20	1.00	8.36	42.73	27.15	25.87	91	50.80
Days to 50 per cent flowering	105.88	2.04	98.00	141.00	8.72	8.06	85	15.32
Days to maturity	147.91	3.19	137.33	164.00	6.56	5.39	67	9.11
No. of effective tillers per plant	7.82	0.36	4.60	11.40	15.06	12.73	71	22.17
Plant height	135.87	2.47	96.30	189.13	13.52	13.15	95	26.34
Panicle length	27.61	0.88	20.63	32.20	10.03	8.34	69	14.29
No. of grains per panicle	210.03	3.71	150.04	325.75	17.42	17.14	97	34.77
1000-grain weight	23.56	1.03	15.33	34.00	17.28	15.53	81	28.75
Kernel length	6.43	0.05	5.32	7.50	8.88	8.78	98	17.87
Kernel breadth	2.35	0.03	1.71	3.37	14.71	14.48	97	29.38
L/B ratio	2.79	0.05	1.86	3.85	17.14	16.77	96	33.80

with the mean values ranging from 15.33 g (BPT 2575) to 34.00 g (CR 2986-2-3-1-1-1).

The observed range of variation for kernel length was from 5.32 (NP 6565) to 7.50 mm (CR 2986-2-3-1-1-1) with a general mean value of 6.43 mm, while kernel breadth ranged from 1.71 mm (CR 29881-2-1-1-1) to 3.37 mm (CN 1476-817-8-19-8) with a mean value of 2.35 mm. Further, observed range for L/B ratio was noticed from 1.86 (RGL 7003) to 3.85 mm (CR 29881-2-1-1-1) with a general mean value of 2.79 mm.

High amount of genetic variability for many of these traits has also been reported by Sinha *et al*. (2004) and Tiwari *et al*. (2011). High estimates of parameters of variability such as GCV and PCV (Table 3) were obtained for grain yield per plant. The genotypic coefficient of variation (GCV) for most of the traits were quite close to estimates of phenotypic coefficient of variation (PCV) indicating negligible environmental effect on expression of the traits for variability studies. Low estimates of GCV and PCV were exhibited for days to 50 per cent flowering, days to maturity, panicle length and kernel length. Further, the estimates of PCV were generally higher than their corresponding GCV for all the characters studied suggesting thereby the important role of environment in the experiment of these traits. Hence the phenotypic selection may not hold good for genetic improvement in these traits. Similar findings for most of these traits with respect to GCV and PCV have been also reported by Patil and Sarawgi (2005) and Tiwari *et al*. (2011).

The information on heritability estimates is useful in studying the inheritance of quantitative traits as well as for planning breeding programmes with desired degree of expected genetic progress. High heritability was observed for almost all the traits. For an effective selection, the knowledge along with the estimates of heritability is not sufficient and genetic advance if studied along with heritability is more useful. In the present study, high estimates of genetic advance expressed as per cent of mean have been observed for grain yield per plant, number of effective tillers per plant, plant height, number of grains per panicle, 1000-grain weight, kernel breadth and L/B ratio.

A relative comparison of heritability estimates and expressed genetic advance will give an idea about the nature of gene action governing a particular character. A comparison of these two estimates made in this study revealed high value of heritability coupled with high genetic advance expressed as percentage of mean for grain yield per plant, number of effective tillers per plant, plant height, number of grains per panicle, 1000-grain weight, kernel breadth and L/B ratio, indicating the substantial contribution of additive genetic variance in the expression of these traits and selection pressure could be profitably applied on these traits for yield improvement. High heritability coupled with high expected genetic advance is in accordance with the findings of Sarawgi *et al*. (2000) and Satyanarayana *et al*. (2005). High heritability coupled with low or medium genetic advance for panicle length, kernel length, days to 50 per cent flowering and days to maturity revealed the importance of dominance and epistatic effect in the inheritance of these traits and selection for these traits would be less effective. Hence, in the present investigation, the study of heritability and genetic advance revealed that there was scope for improvement and realisation of higher genetic gains from selections for yield based on number of effective tillers per plant, number of grains per plant and 1000-grain weight.

LITERATURE CITED

Burton G W and Devane E H 1953 Estimating heritability in tall fescue (Festuca arundinaceae) from replicated clonal material. *Agronomy of Journal,* 45: 478-481.

Johnson H W, Robinson H E and Comstock R E 1955 Estimates of genetic and environmental variability in soybean. *Agronomy of Journal,* 47: 314-318.

Panse V G and Sukhatme P V 1985 Statistical methods for agricultural workers. Indian Council of Agricultural Research, New Delhi.

Patil P V and Sarawgi A K 2005 Studies on genetic variability, correlation and path analysis in traditional aromatic rice accessions. *Annals of Plant Physiology*, 19 (1): 92-95.

Sarawgi A K, Rastogi N K and Soni D K 2000 Studies on some quality parameters of indigenous rice in Madhya Pradesh. *Annals of Agricultural Research,* 21: 258-261.

Satyanarayana P V, Srinivas T, Raghava Reddy P, Madhavilatha L and Suneetha Y 2005 Studies on variability, correlation and path coefficient analysis for restorer line in rice (*Oryza sativa* L.). *Research on Crops*, 6 (1): 80-84.

Sinha S K, Tripati A K, Bisen U K 2004 Study of genetic variability and correlation coefficient analysis in mid land landraces of rice. *Annals of Agricultural Research,* 25 (1): 1-3.

Tiwari D K, Pandey P, Tripathi S, Giri S P and Dwivedi J L 2011 Studies on genetic variability for yield components in rice. *AAB Bioflux*, 3 (1): 76-81.

(Received on 23.07.2013 and revised on 01.06.2015)