"EVALUATION OF AROMATIC SHORT GRAIN RICE CULTIVARS AND ELITE LINES FOR YIELD AND QUALITY PARAMETERS"

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Abstract

Significant genetic variability was observed among 13th aromatic short grain genotypes include two elite lines and one local check of rice for yield and quality parameters indicating that there is presence of sufficient amount of variability in the study material and there is scope of selection. The genotype CN1646-6-11-9 found best for mean performance of grain earliest yield, its component and quality traits except HRR% and gel consistency which was statistically at par with highest yielder genotype Pant Dhan-4(check). High heritability coupled with high genetic advance were recorded for number of spikelets per panicle, L/B ratio, volume expansion ratio and gel consistency indicated the major role of additive gene action in the inheritance of these character and these character could be improved by selection in segregation generation. Thus parameter during breeding programme for crop improvement

***Keywords**: aromatic rice, genetic variability, heritability, genetic advance, grain physical quality, grain cooking quality.*

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1. INTRODUCTION

Rice (*Oryza sativa* L.) is the world's most important food crops of Asian origin and belongs to genus oryza of family graminae. India has 43.77 m.ha area under rice and production 96.43 m.tones (Agri. Statistics at a Glance, 2008)**.** India shares the world is 21.6% rice production. India holds 2nd and China 1st position in rice production in the world (FAO, 2007). Rice remains a stable food for majority of the world population. More than two thirds of the worlds relies of the nutritional benefit of rice. The available variability in a population can be partitioned into heritable and non-heritable parts with the aid of genetic parameters such as genetic coefficient of variation, heritability and genetic advance (Miller *et al.*, 1958).Aromatic rice with extra long and soft textured grain double expansion in length after cooking with excellent taste are unique characterization of basmati rices. There is appreciable demand for such rice in the international domestic market (Dhiman, 2009). Estimates of GCV, PCV, heritability and genetic advance will play an important role in exploiting further research projections of rice improvement. Therefore, an attempt was made in the present studies to estimate the extent of variability, heritability, genetic advance for yield and quality improvement in aromatic rice.

2. MATERIALS AND METHODS

The experimental material for the present study consisted of 13 aromatic short grain genotypes include two elite line and one local check of rice which were evaluated in a randomized block design in three replications in 10 m^2 plot at field, laboratory, experimentation centre of Department of Genetics and Plant Breeding, Sam Higginbottom Institute of Agriculture, Technology and Sciences (Deemed to be University), Allahabad during kharif season 2009, Allahabad is situated at latitude 25.57^{0}N; longitude 81.5^{0}E and altitude 98 meters from sea level. The recommended cultural practices were followed to raise the crop. The observations were recorded 10 randomly selected plants from each replication for characters viz., number of panicles per hill, number of spikelets per panicle, test weight of grain, days to maturity, grain yield per hill, hulling, milling, head rice recovery, L/B ratio, volume expansion ratio, elongation ratio and gel consistency. Gel consistency was measured in duplicate according to the method of Cagampang *et al.* (1973).

The mean value were subjected to analysis of variance to test the significance for each character as per methodology advocated by Panse and Sukhatme (1967). PCV and GCV were calculated by the formula given by Burton and Devane (1953) and genetic advance i.e. the expected genetic gain were calculated by using the procedure given by Johnson *et al.* (1995).

3. RESULTS AND DISCUSSION

On the basis of mean performance of yield and yield contributing traits Pant Dhan-4 (check) was highest yielder which were statistically at par with CN1646-6-11-9 for quality parameter CN1646-6-11-9 were good except two character viz., HRR and gal consistency. Milling percentage of Pant Dhan-4 (check) was best followed by NDR9543 and CR266-14-11-2-1-3 (Table 1). The genotypes CN1646-6-11-9 found best grain earliest yielder. Whereas the maximum gel consistency and good cooking quality was depicted by genotype Pant Dhan-4 (check).The analysis of variance revealed highly significant differences among the genotypes for the entire test characters, indicating the existence of high variability among the genotypes. Thus, there is ample scope for selection of different qualitative and quantitative characters for rice improvement.

The estimates of phenotypic (σ_p) and genotypic (σ_g) variation were obtained for different characters and they are presented in Table 2. A wide range of phenotypic variance was observed for the characters like – number of spikelets/panicle. Head rice recovery gel consistency and days to maturity.

Whereas lower range phenotypic variance was observed for the characters like volume expansion ratio and elongation ratio. Genetic variance is lower than the phenotypic variance for all the yield and quality character studied.

A perusal of GCV revealed that maximum value genetic coefficient of variation (GCV) was recorded for grain yield/hill (39.12) followed by gel consistency (36.43), L/B ratio (31.53), test weight (28.33) and head rice recovery (26.84). Grain yield/hill (40.34) exhibited maximum phenotypic coefficient of variation (PCV) followed by gel consistency (36.56), L/B ratio (31.54) and test weight (28.49). These results are in confirmation to the findings of Ubarhande et al. (2009). (see table 1). The magnitude of phenotypic coefficient of variation was higher than genotypic coefficient of variation for all the character which may be due to higher degree of interaction of genotypes with the environment (Kavitha and Reddy, 2002).

These values alone are not helpful in determining the heritable portion of variation (Flaconer, 1960). The proportion of genetic variability which is transmitted from parents to offspring is reflected by heritability (Lush, 1949). In the present study high broad sense heritability was observed for traits like *viz.*, L/B ratio (99.89%), number of spikelets/panicle (99.65%), volume expansion ratio (99.38%) and gel consistency (99.32%). While lowest heritability was observed in number of panicle/hill (79.49%), (see table 2). Kumar *et al*. (2009) also reported higher estimation of broad sense heritability for L/B ratio.

Genetic advance measures the difference between the mean genotypic values of selected population and the original population from which these were selected. The highest genetic advance as % of mean was recorded for volume expansion ratio (96.75) followed by grain yield/hill (82.27) and gel consistency. While lowest genetic advance as percent of mean was recorded for Hulling % (7.48) followed by elongation ratio (10.35) (see table 2).

A character exhibiting high heritability may not necessarily give high genetic advance; Johnson *et al.* (1955) have should that high heritability should be accompanied by high genetic advance to arrive at a more reliable conclusion. Therefore, it should combined with information on genetic advance. Thus a character, the genetic advance was very low with high genetic advance in percent of mean was reported by the Biswas *et al.* (2000).

It can be concluded the considerable genetic variability was found among the experiment material and genotypic CN1646-6-11-9 found best for mean performance of grain earliest yield, its component and quality traits except HRR % and gel consistency.

Number of spikelets, L/B ratio, volume expansion ratio, volume expansion ratio and gel consistency depicted at par value with check for high variability and genetic advance. This proved its genetic work was selection.

Table 1 Mean performance of 13[th] rice genotypes for their yield and grain quality parameters.

S. No.	Character / Genotypes	No. of panicles/ hill	No. of spikelets/ panicle	Days to maturity	Grain yield /hill (g)	Test weight (g)	Hulling (%)	Milling (%)	Head rice recovery (%)	L/B ratio	Volume expansion ratio	Elongation ratio	Gel consistency (mm)
1	**PNR 2354**	12.86	246.57	121.00	25.48	14.806	80.14	69.57	57.73	2.95	0.080	1.21	43.33
2	**CN1646-6-11-9**	15.62	271.03	112.33	37.99	21.613	67.30	60.80	27.65	4.01	0.032	1.10	28.00
3	**CN1643-2**	9.89	341.72	127.67	14.03	10.566	72.71	68.15	66.08	2.03	0.030	1.13	51.66

4	**NDR 8400-2 (IR 76223-1-NDR-B-1-6)**	13.86	230.33	145.66	27.03	15.866	63.13	53.80	40.41	2.96	0.040	1.23	81.33
5	**NDR 9543**	12.13	209.79	135.33	16.83	13.38	76.63	70.82	56.55	2.73	0.052	1.37	50.33
6	**NDR 6311**	9.86	217.96	145.00	15.86	13.54	75.64	69.04	67.02	2.55	0.065	1.21	51.00
7	**CR 266-14-11-2-1-3**	13.85	248.04	135.33	17.90	13.78	70.20	70.12	56.31	2.96	0.133	1.24	43.66
8	**NWGR-3108**	14.53	207.40	115.00	24.74	18.01	72.14	69.45	35.07	3.33	0.093	1.14	91.00
9	**NDR 9542**	15.51	316.40	145.33	24.55	19.11	61.2	55.38	54.04	2.35	0.075	1.23	40.00
10	**RNR 2465-1**	10.83	228.04	128.00	17.01	13.61	69.68	60.74	54.39	2.52	0.061	1.17	83.66
11	**KALANAMAK (KN-3)**	11.66	187.90	146.00	15.25	13.06	75.50	68.78	66.80	2.58	0.102	1.30	47.00
12	**KJT-4-4-36-12-13-29**	15.56	257.41	129.66	24.85	20.066	68.77	58.29	41.08	3.30	0.139	1.23	71.00
13	**Pant Dhan-4 (check)**	16.70	267.16	121.00	43.07	28.03	86.66	73.46	70.54	2.42	0.053	1.26	95.00
	GM	13.44	248.44	131.33	22.68	16.57	72.32	65.26	54.28	2.83	0.073	1.218	59.76
	Range	9.86-16.7	187.90-341.72	112.33-146.00	14.03-43.07	10.56-28.03	61.20-86.66	53.80-73.46	27.65-70.54	2.03-4.01	0.032-0.139	1.10-1.37	28.00-95.00
	SEm	0.59	1.467	1.24	1.66	0.28	1.69	0.92	1.16	0.01	0.001	0.014	1.039
	CV	7.56	1.02	1.63	9.85	2.98	3.90	2.45	3.70	0.86	3.700	2.110	3.01
	CD(5%)	1.44	4.29	3.62	3.77	0.834	4.93	2.70	3.39	0.04	0.004	0.040	3.033

Table-2: Estimates of variability of 13th rice genotypes for yield and grain quality parameters.

S. No.	Characters	$\sigma^2 g$	$\sigma^2 p$	GCV	PCV	h^2(%)	GA	GA% M
1	**No. of panicle/hill**	4.07	5.12	15.08	16.83	79.49	3.68	27.38
2	**No. of spikelets/ panicle**	1896.24	1902.72	17.52	17.57	99.65	88.95	35.80
3	**Days to maturity**	140.45	145.08	9.02	9.17	96.80	23.82	18.13
4	**Grain yield/hill**	78.74	83.74	39.12	40.34	94.02	18.66	82.27
5	**Test weight**	22.04	22.29	28.33	28.49	98.87	9.53	57.51
6	**Hulling**	43.97	52.55	9.16	10.02	83.67	5.41	7.48
7	**Milling**	41.70	44.30	9.89	10.19	94.13	12.88	19.73
8	**Head rice recovery**	212.27	216.32	26.84	27.09	98.12	29.78	54.86
9	**L/B ratio**	0.796	0.796	31.53	31.54	99.89	1.82	64.31
10	**Volume expansion ratio**	0.0011	0.0012	0.472	0.474	99.38	0.071	96.75
11	**Elongation ratio**	0.004	0.005	5.44	5.90	86.27	0.12	10.35
12	**Gel consistency**	474.16	477.4	36.43	36.56	99.32	44.55	74.56

$\sigma^2 g$ -Genotypic variance, $\sigma^2 p$-Phenotypic variance, PCV- Phenotypic coefficient of variance, GCV- Genotypic coefficient of variance, h^2 (bs)- Heritability (broad sense) and GA-Genetic advance, GA%M- Genetic advance, as percent of mean.

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