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Research Article

EVALUATION OF EARLY MATURING RICE (*Oryza sativa* L.) HYBRIDS FOR YIELD AND GRAIN QUALITY CHARACTERS

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Abstract- An experiment was conducted to evaluate 32 rice hybrids for yield and quantitative characters during *Kharif*-2015. The data were recorded on 13 quantitative characters to study genetic variability, heritability, and genetic advance. Analysis of variance among 32rice hybrids showed highly significant differences for all the characters indicated the presence of substantial amount of genetic variability for all the characters. Based on mean performance high grain yield per hill was observed for hybrid IHRT-E-22 followed by IHRT-E-23. High phenotypic and genotypic coefficient of variation (PCV) was observed for Flag leaf length followed by biological yield indicating that environment highly influenced these characters. High estimate of heritability was observed for test weight and plant height.
Keywords- Hybrid Rice, Genetic variability& Quality.

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Introduction

Rice (*Oryza sativa* L) is the most important staple food crop of the world. More than 90 per cent of the world's rice is grown and consumed in Asia, known as rice bowl of the world, where 60 per cent of the earth's people and two third of world's poor live. Uttar Pradesh 5.93 million hectare its production 14.03 million tones and productivity is 2.35tones/hectare [1].

The agricultural food production must continue to meet the demands of growing populations. Although, the average productivity of rice is much lower in India than the average productivity at world level. The projection of India's rice production target for 2020 AD is 115-120 million tones, which can be achieved only by increasing the rice productivity by over 2.0 million tones/year in the coming decade [2]. This must be done against backdrop of diminishing natural resource bases like land, labor and water, which is a huge challenge [3]. Considering the rapidly decreasing availability of agricultural land due to urbanization and industrialization, utilization of different eco-systems and under exploited stress environments for rice production would be needed. Thus, adoption of high yielding rice varieties to various stress environments and underutilized lands such as sodic and other problem, soils would be an important strategy to meet this challenge. To step up the production potential, there is, thus, an urgent need to launch a dynamic breeding programme to develop hybrids suitable for different agro-climatic regions. For planning and execution of a successful breeding programme, the most essential pre-requite is the availability of substantial desirable genetic variability for important characters in the germplasm collections of the plant species in question. Germplasm serves as most valuable natural reservoir in providing needed attributes for engineering successful varieties [4].

Hybrid rice has been created by crossing two different parental strains. The 'A' line seed thus obtained will be grown along with 'R' line in isolation to produce hybrid rice seed [5]. F1 generation is called 'Hybrid'. The hybrid breeding methodology involves the three approaches (a) Three-line method or CMS system which is possible and has been found to be most effective genetic.

Information on the nature and magnitude of gene effects for grain yield and its component characters are essential in deciding a sound strategy for improving the large spectrum of genetic variation in segregating population depends on the level of genetic diversity among the genotypes offer better scope for selection [6].

Quality parameters are very important attributes of the rice. Cooking and eating characteristics are largely demanded by the properties of the starch that makes up 90% of milled rice. Gelatinization temperature, amylose content and gel consistency are the important starch properties which influence cooking and eating characteristics. A complex relationship however exits, between chemical characters and quality characters. New technologies like metabolomics are also being used to get more insight into complex traits like taste, fragrance, nutritional value, genetic and environmental factors influencing these quality related traits. Development of high yielding varieties with superior milling and cooking qualities is now one of the most important objectives in all rice improvement programmes [7]. There should be proper post-harvest handling. Head rice recovery can also be 5-6% increased through the process of parboiling.

Materials and Methods

Experimental materials for the present study consist of 32 early maturerice hybrids including check received from Indian Institute of Rice Research, Hyderabad (IIRR-ICAR) during *Kharif*-2015. The experiment was laid in Randomized Block Design (RBD) with thirty-two genotypes in three replications. Days to maturity, Biological Yield(g), Harvest Index (%), Test Weight(g), Grain/Plant(g), Days to 50% flowering, Plant height(cm), Flag leaf length(cm), Flag leaf Width (cm) No. of Tillers/plant, No. of panicles/plant, Panicle length(cm), No of spikelet's/panicle.

Results and Discussion

There was a good correspondence between genotypic and phenotypic coefficient of variation for all the characters studied. The genotypic coefficient of variation is most important and useful in the measurement of range and to compare the genetic variability of the quantitative traits. The high genotypic coefficient of variation accompanied with high phenotypic coefficient of variation was observed for flag leaf length suggests that an enough genetic variability is present among rice hybrids. Therefore, selection will be more effective in isolating the superior hybrids. For the traits where PCV and GCV are moderate to low, the scope of selection for suitable characters is limited [8]. A character exhibiting high heritability may not necessary give high genetic advance have shown that high heritability accompanied by high genetic advance to arrive at more reliable conclusion. The breeder should be caution in making selection based on heritability as it includes additive and non-additive gene effect. So, it should be combined genetic advance for such variability. Thus, genetic advance is other important selection parameters, which is not independent represent the expected genetic advance under selection. It measures the differences between the mean genotypic values of the original population from which these were selected.

Genotypic coefficient of variation (GCV) was observed for different traits. It ranged from 2.76 to 46.14. Higher magnitude of genotypic coefficient of variation (GCV) were recorded for days to flag leaf length (46.14), followed by tillers per hill (28.84), plant height (24.21), panicles per plant (21.86), seed yield per hill (16.42), panicle length (14.24), spikelets per panicle (11.97), biological yield (22.40), flag leaf width (15.69),days to maturity (10.63), Harvest Index (9.86%),showed moderate GCV values. While, 50% flowering (2.76), showed low GCV values. These findings agree with the findings of similar results Similar findings were also supported by Singh and Choudhary (1996) and Anurag et al. (2009) [9, 10]. Phenotypic coefficient of variation (PCV) ranged from 3.28 to 52.02. Higher magnitude of phenotypic coefficient of variation (PCV) were recorded for flag leaf length (52.02) followed by tillers per hill (30.98), whereas panicles per plant (26.84), plant height (24.77), biological yield (23.01), harvest index (16.51) grain yield per hill (16.99) panicle length (15.52), flag leaf width (14.23), and spikelets per panicle (12.28) showed moderate phenotypic coefficient of variation (PCV) value. While, days to maturity (10.74), test weight (8.01) and days to 50 % flowering (3.28) showed low phenotypic coefficient of variation (PCV) value. Similar results were also quoted by Anurag et al. (2009) [10].

Table-1 Analysis of Variance for 13 quantitative characters in 32 rice hybrids during Kharif-2015

S. No.	Characters	Mean sum of squares		
		Replications df=(02)	Treatments df=(31)	Error df=(62)
1	Days to 50% flowering	3.260	5.997**	2.207
2	Plant height	14.079	343.633**	15.676
3	Flag leaf length	30.803	180.273**	44.857
4	Flag leaf width	0.002	0.024**	0.011
5	Number of tillers per hill	11.479	29.544**	4.326
6	Number of panicle per hill	1.793	4.281**	1.857
7	Panicle length	2.801	11.562**	2.047
8	Number of spikelets / panicle	20.151	237.980**	13.411
9	Days to maturity	7.102	123.210**	20.887
10	Biological yield	3.762	100.518**	5.492
11	Harvest index (%)	3.415	49.373**	5.104
12	Test weight	1.429	2.585**	0.794
13	Seed yield per pant	1.713	10.303**	0.714

Heritability is measure of extent of phenotypic variance caused by the actions of genes. For making effective improvement in the characters for which selection is practiced, heritability has been adopted by genetic variability, which is transmitted from parent to offspring is reflected by heritability. According to Lush (1949), heritability in broad sense is the ratio of total genotypic variance and phenotypic variance, expressed in percentage [11]. The estimates of heritability are more advantageous when expressed in terms of genetic advance.

The estimates of heritability ranged from 65.07 to 95.57. High heritability was observed for both the traits like plant height (95.57) followed by days to maturity (95.00) whereas moderate heritability was exhibited by biological yield (94.72), grain yield per hill (93.38), spikelet's per panicle (93.17), harvest index (90.32), tillers per hill (86.66),panicle length (84.17), flag leaf length (78.66),test weight (74.51), days to 50% flowering (70.45) and panicles per plant (66.36) while the minimum value of heritability was depicted by flag leaf width (65.07) by Yadav et al. (2002), Sharma and Sharma (2007) [12,13].

Table-2 Genetic parameters of 13 quantitative characters of rice hybrids during Kharif-2015

Sl. No.	Characters	$\sigma^2 g$	$\sigma^2 p$	GCV	PCV	h^2 (bs) (%)	GA	GA as percent of mean
1	Days to 50% flowering	5.26	7.47	2.76	3.28	70.45	3.97	4.77
2	Plant height	338.41	354.08	24.21	24.77	95.57	37.05	48.76
3	Flag leaf length	165.32	210.18	46.14	52.02	78.66	23.49	84.29
4	Flag leaf width	0.02	0.03	11.48	14.23	65.07	0.24	19.08
5	Tillers per hill	28.10	32.43	28.84	30.98	86.66	10.17	55.31
6	Panicle per plant	3.66	5.52	21.86	26.84	66.36	3.21	36.69
7	Panicle length	10.88	12.93	14.24	15.52	84.17	6.23	26.91
8	Days to maturity	182.82	196.23	10.63	11.02	93.17	26.88	21.14
9	Spikelet per panicle	233.89	246.18	11..97	12.28	95.00	30.70	24.02
10	Biological yield	98.68	104.18	22.40	23.01	94.72	19.92	44.91
11	Harvest index	47.67	52.78	15.69	16.51	90.32	13.51	30.72
12	Test weight	2.32	3.11	6.92	8.01	74.51	2.71	12.30
13	Grain yield per hill	10.07	10.78	16.42	16.99	93.38	6.32	32.68

$\sigma^2 g$- Genotypic variance $\sigma^2 p$ - Phenotypic variance GCV - Genotypic coefficient of variance PCV- Phenotypic coefficient of variance h^2(bs)-Heritability (broad sense) GA-Genetic advance

The estimates genetic advance ranged from 0.24 to 37.05. High genetic advance was observed for number of plant height (37.05) followed by spikelet's per panicle (30.70) and flag leaf length (23.49). Moderate genetic advance was observed for days to maturity (20.45), biological yield (19.92), harvest index (13.51), tillers per hill (10.17), seed yield per plant (6.32) and where as low genetic advance was observed for panicle length (6.23), days to 50% flowering (3.97), panicles per plant (3.21), test weight (2.71) and flag leaf width (0.24) by Elayaraja et al. (2005) for biological yield per plant Suman et al. (2005) [14,15]. Quality characters- The best genotype for different characters are given in [Table-2]. The hybrid IHRT-E-22(69.23%) highest hulling percent, kernel breath cooking before and after and followed by IHRT-E—19. Elongation ratio is important parameters for cooked rice. Elongation ratio highest IHRT-E-4 and followed by IHRT-E-3, IHRT-E-12. Kernal length before and kernel length after is best hybrids [16-25].

Table-3 *Mean Performance of best 10 Rice Hybrids for Quality trait*

SL. No.	Hybrids	Hulling (%)	Kernel Length Before Cooking (mm)	Kernel Breadth Before Cooking (mm)	Kernel Length After Cooking (mm)	Kernel Breadth After Cooking (mm)	L/B Ratio (mm)	Elongation Ratio (mm)
1	IHRT-E-1	65.14	6.35	2.80	8.86	3.27	2.27	1.39
2	IHRT-E-2	67.07	7.04	2.51	8.80	3.32	2.87	1.24
3	IHRT-E-3	64.87	6.22	2.46	8.74	3.41	2.60	1.42
4	IHRT-E-4	66.48	6.00	2.50	8.77	3.39	2.47	1.47
5	IHRT-E-6	68.82	6.51	2.27	8.63	3.20	2.89	1.32
6	IHRT-E-12	67.77	7.07	2.34	8.51	3.07	3.12	1.20
7	IHRT-E-19	68.98	6.37	2.90	8.34	3.50	2.20	1.31
8	IHRT-E-22	69.23	6.46	2.90	8.17	3.36	2.24	1.29
9	IHRT-E-24	68.42	6.51	2.28	8.37	3.24	2.87	1.29
10	IHRT-E-25	68.37	6.34	2.34	8.45	3.04	2.76	1.35
Mean		67.51	6.48	2.53	8.56	3.28	2.62	1.32
Range	Maximum Range	69.23	7.07	2.90	8.86	3.50	3.12	1.47
	Minimum Range	64.87	6.00	2.27	8.17	3.04	2.20	1.20
CD5%		3.03	1.09	0.45	0.57	0.47	0.74	0.23
CV		2.62	9.80	10.35	3.86	8.41	16.31	10.23

Conclusion

It is concluded that rice hybrid IHRT-E-22 recorded high seed yield per plant 24.08gm (6.8 t/ha) among the 32-rice hybrid evaluated during kharif-2015 season and IHRT-E-29 is observed as early mature rice hybrid (104.00 days) about quality parameters hybrid (IHRT-E-22) recorded 69.23%hulling percent, good kernel length before and after cooking and best elongation ratio. Since, one-year data is not sufficient to confirm the results further experimentation is required for confirm the results.

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Abbreviations:

σ^2g-Genotypic variance σ^2p-Phenotypic variance GCV-Genotypic Coefficient of Variance PCV-Phenotypic coefficient of variance, h^2(bs)- Heritability (broad sense) GA-Genetic Advance.

Conflict of Interest: None declared

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