# STUDIES ON GENETIC VARIABILITY AND PATH ANALYSIS IN RICE (Oryza sativa L.) GERMPLASM

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## **INTRODUCTION**

Rice (*Oryza sativa* L.) is the most important staple food crop of the world. About 90 percent of world rice is produced and consumed in Asian region. There are two distinct type of domestic rice, *Oryza sativa* L. of Asian origin and second *Oryza glabarrima* L. of African origin. This genus contains 22 wild relatives also. All members of the rice genus have n = 12 chromosome.

Globally it is cultivated in an area of 160.6 m ha with an annual production of about 738.2 million tones and an average productivity of 2.96 t ha-1(FAO, 2015). Among the rice producing countries, India ranks second in total production next to China with an average productivity of 3.09 t/ ha-1(FAO, 2015). More than 8% of our countrymen depend fully or partially on rice as their main cereal food and staple diet.

India has the largest area under rice as 43.95 million hectare with a production of 105.48 million tones. (Directorate of economics and statistics, Department of agriculture and cooperation, Government of India 2015). In Uttar Pradesh area, production and productivity is 5.98million hectare, 14.63 million tonnes, and 2447 kg/ha respectively.(Agricultural statistics at a glance-2014, Department of agriculture and cooperation, ministry of agriculture, Government of India 4th advance estimate). The success of any breeding programme depends on the exploitation of existing variability and therefore, it is desirable to collect, evaluate and utilize the available diversity for crop improvement to suit specific need with regards to specific ecosystem. The nature and relationship between yield and its component traits and also among yield components seems to provide information, which would be of greater value at the time of practicing selection for improved yield. Correlation coefficient measures the relationship between two characters and does not indicate relative importance of each factor, this study was conducted to determine the nature of relationship between seed yield and yield components. Correlation studies provide information about yield contributing characters. This information is useful to plant breeder in selection of elite genotypes from diverse genetic populations (Robinson et al., 1951; Johnson et al., 1955). Simple correlation studies do not provide adequate information about the contribution of each factor towards yield. Therefore, the use of path-coefficient analysis is necessary. Path coefficient analysis partitions into direct and indirect matrix presenting correlation in a more meaningful way. The present investigation was conducted to find out the genetic variability among different characters, direct and indirect contribution of these characters towards yield and to identify better combinations as selection criteria for developing high yielding fine rice genotypes.

## **ABSTRACT**

The experiment was conducted with 30 genotypes of rice during Kharif-2015 in Randomized Block Design. The data were recorded for 13 quantitative characters to study genetic variability, heritability, genetic advance, correlation and path coefficient analysis. On the basis of mean performance highest seed yield per plant reported in KR-15-01 (43.36) genotype followed by KR-15-05 (39.93). Analysis of variance revealed significant difference among 30 rice genotypes for all characters indicating the existence of variability. High GCV and PCV were observed for biological yield per plant (17.29 & 21.72) and harvest index (16.51 & 23.72). High heritability coupled with high genetic advance as percent of mean was observed for the character test weight (96.30 & 30.05). Correlation coefficient showed panicles per plant (0.49) and biological yield per plant (0.48) exhibited maximum direct effect on seed yield per plant. Path coefficient analysis revealed that tillers per plant (2.41), panicles per plant (2.33), harvest index (0.72) exhibited maximum direct effect on seed yield per plant showed to be the primary yield contributing characters and could be relied upon for selection of genotypes to improve genetic yield potential of rice. Hence, utmost importance should be given to these characters during selection for yield improvement.

## **KEY WORDS**

Variability Heritability Genetic advance, Correlation coefficient, Path analysis

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## MATERIALS AND METHODS

The experiment was conducted during Kharif - 2015 at the Central Research Farm of the Department of Genetics and Plant breeding, Faculty of Agriculture, Sam Higginbottom Institute of Agriculture, Technology and Sciences, (Deemed to be University) Allahabad, Uttar Pradesh, India, with 30 rice genotypes sown in a randomized block design with three replications. Twenty five days old seedlings of each genotype were transplanted in a row of 4.0 m length by adopting a spacing of 20 cm between rows and 15 cm between plants within the row. Observations were recorded on five randomly selected plants in each genotype in each replication and the average values were subjected for statistical analysis. Observations were recorded on plant basis for all characters, except days to 50 per cent flowering and days to maturity which were recorded on plot basis. The differences between 30 genotypes for different characters were tested for significance by using Analysis of Variance technique as proposed by Panse and Sukhatme (1967). The genetic parameters genotypic coefficient of variation (GCV) and phenotypic coefficient of variation (PCV) were calculated by the formula given by Burton (1952), heritability (h2) by Burton and De Vane (1953) and genetic advance i.e. the expected genetic gain were calculated by using the procedure given by Johnson et al. (1955). Correlation coefficient and path coefficient was worked out as method suggested by Al libouri et al. (1958). Dewey and Lu (1959). The estimated values compared with table values of correlation coefficient to test the significance of correlation coefficient prescribed by Fisher and Yates (1967).

#### **RESULTS AND DISCUSSION**

The analysis of variance showed highly significant differences among the various genotypes for the characters under study. It indicated that there is ample scope for selection of different quantitative characters for improvement of rice. These findings are in accordance with the findings of Akinwale et al (2011), Mulugeta et al (2012) who also observed significant variability for yield and its components traits in rice. The result of analysis of variance is present in the Table1. On the basis of mean performance highest seed yield per plant was exhibited by the

genotypes KR-15-01 (43.36) followed by KR-15-05 (39.93), KR-15-03 (37.85), PHB-71 (34.56) and KR-15-09 (33.95). The result of mean performance is given in the table2. The Phenotypic coefficient of variation was higher than genotypic coefficient of variation for all the characters studied. Maximum genotypic coefficient of variation (GCV) and phenotypic coefficient variation (PCV) was observed for biological yield per plant (17.29, 21.72) and harvest index (16.51, 23.72) indicating that these characters could be used as selection for crop improvement. Similar results were also found by Zahid et al. (2006). Heritability is classified as high (above 60%), medium (30%-60%) and low (below 30%). High heritability was observed for test weight (96.30), days to maturity (90.60), days to 50% flowering (87.60), number of tillers per plant (65.80), biological yield per plant (63.40), plant height (63.00), number of panicles per plant (62.30), seed yield per plant (62.20). High heritability for test weight, days to 50% flowering, days to maturity was also observed by Ashvani et al. (2007) and Warakad et al. (2013). High genetic advance was observed for number of spikelets per panicle (19.77). Similar results were also reported by Navak et al., (2002) and Singh et al., (2011). High genetic advance as percent of mean was observed for test weight (30.05), biological yield per plant (28.37), seed yield per plant (26.58), harvest index (23.69), number of panicles per plant (21.44), number of tillers per plant (20.54). Yadav (2000) reported that seed yield per plant showed high genetic advance as percent of mean. High heritability coupled with high genetic advance as percent of mean was observed for test weight (96.30, 30.05). The result of estimation of components of variance and genetic parameters present in the table3. Correlation studies revealed that panicles per plant (0.49), biological yield per plant (0.48), harvest index (0.43), tillers per plant (0.43), number of spikelets per plant (0.39) and plant height (0.35) showed positive significant association with seed yield per plant at genotypic level. Similar results were reported by Panwar et al. (2007), Kole et al. (2008), Nandan et al (2010), Paul et al. (2011), ), Pandey et al. (2012), Ishwar et al. (2012), Sharma et al. (2012) and Singh et al. (2013) for seed yield at genotypic level. The result of genotypic correlation coefficient between yield and its related traits present in the table4. Harvest index (0.47), biological yield per plant (0.40), tillers per plant (0.40), numbers of panicles

Table 1: Analysis of variance for 13 characters in rice germplasm

S.no	Characters	Mean squares Replication(d.f = $2$ )	Treatments(d.f = $29$ )	Error(d.f = 58)
1	Days to 50% flowering	13.73	313.32**	14.11
2	Plant height	2.49	158.36**	25.92
3	Flag leaf length	1.93	38.69**	9.72
4	Flag leaf width	0.006	0.03 * *	0.01
5	Numbers of tillers per plant	0.13	7.03 * *	1.03
6	Number of panicles per plant	0.12	5.95**	1.00
7	Panicle length	1.53	3.68**	1.50
8	Number of spikelets per panicle	108.48	1939.17**	917.61
9	Days to maturity	12.57	279.15**	9.32
10	Biological yield per plant	84.66	387.29**	62.52
11	Harvest index	11.04	267.63**	70.02
12	Test weight	0.18	29.05**	0.36
13	Seed yield per plant	24.83	79.51**	13.37

<sup>\*\*</sup> Significant at 1% probability level.

Table 2: Mean performance of 30 rice genotypes for 13 characters during Kharif-2015

Name of the control of the c						l	) ;		-			-	:		-
Fig. 1976   Posight   leagth   leagth width illiest   panicles   panicles   maturity   yield   indox   Fig. 1875   Fig. 1875	S.no		Days to	Plant	Flag leat	Flag		No. ot	Panicle	No. ot	Days to	Biological	Harvest	est	Seed yield
House,   H			20%	height	length	leaf width		panicles	length	spikelets	maturity	yield /	index	weight	/plant
KR-15-01 85.66 119.60 37.66 1.30 144.5 11.30 24.20 233.21 115.66 83.24 55.15 32.24 45.15 14.80 14.80 14.80 14.80 14.80 11.80 14.80 14.80 12.80 11.80 14.80 25.30 24.40 23.34 11.81 35.80 32.44 32.80 34.40 12.80 12.80 12.80 22.80 23.94 11.73 36.60 24.46 22.80 23.94 11.73 36.60 49.95 37.77 11.80 39.80 34.4 22.80 23.44 11.73 36.60 49.95 37.73 14.80 30.80 83.4 22.80 23.44 22.80 23.44 22.80 23.44 22.80 23.44 22.80 23.75 30.95 30.95 30.95 30.95 30.95 30.95 30.95 30.95 30.95 30.95 30.95 30.95 30.95 30.95 30.95 30.95 30.95 30.95 30.95			flowering	(cm)	(cm)	(cm)	/plant	/plant	(cm)	/plant		plant (gm)	(%)	(gm)	(gm)
KR-15-03 86.33 112.13 35.66 15.0 11.86 10.48 25.33 24.81 11.61.33 76.15 35.00   KR-15-04 88.03 112.13 34.66 15.0 10.20 10.64 22.86 229.99 117.33 76.75 34.00 13.61 14.53 76.20 23.44 17.00 12.17 10.40 22.86 229.99 117.33 76.75 34.00 34.00 23.61 14.53 76.20 23.64 44.96 52.06 44.32 83.75 14.8 11.2 10.00 22.00 22.00 23.64 14.00 22.00 23.64 14.96 24.46 22.00 23.64 14.96 44.96 32.00 23.64 44.96	<u>.</u>	KR-15-01	85.66	119.60	37.66	1.30	14.45	11.93	24.20	253.21	115.66	83.74	52.24	23.36	43.36
KR-15-05 88.00 113.60 34.80 15.6 12.44 22.84 117.66 76.9 23.94 117.66 26.90 23.94 117.33 105.73 38.46 12.0 12.86 22.89 117.33 0.0 2.0 17.0 11.1 10.0 22.80 23.94 11.76 36.0 37.73 14.8 9.86 3.44 2.00 2.0 17.0 11.2 8.68 2.20 25.0 17.76 9.90 37.73 1.48 9.80 8.44 2.00 2.0 17.0 9.80 8.44 2.00 2.0 1.0 9.80 8.44 2.00 2.0 9.80 9.84 9.86 1.0 9.80 <	5.	KR-15-03	86.33	112.13	35.86	1.50	11.86	10.48	25.53	248.11	116.33	76.15	50.27	22.16	37.85
KR-15-O7 87.33 105.78 3.84 1.27 1.217 1.04 22.08 22.09 115.33 56.29 52.37   KR-15-O7 115.33 105.76 34.26 1.77 1.128 6.68 22.08 236.11 1.37 6.98   KR-15-13 107.66 99.06 35.03 1.70 11.28 8.68 2.446 22.76 13.76 6.30 6.49   KR-15-15 116.00 99.26 37.33 1.48 9.80 8.44 22.06 21.76 6.99 6.49   KR-15-16 99.06 37.03 1.73 1.42 1.12 1.04 22.06 27.06 49.99 44.46 44.60 45.90 44.40 44.60 44.60 44.60 44.90 44.60 44.70 44.80 44.60 44.60 44.60 44.60 44.60 44.60 44.60 44.60 44.60 44.60 44.60 44.60 44.60 44.60 44.60 44.60 44.60 44.60	3.	KR-15-05	88.00	113.60	34.80	1.56	12.02	10.66	24.46	233.44	119.66	74.98	53.77	19.66	39.93
KR-15-09 115.33 107.86 34.26 1.71 986 7.84 22.00 23.61 1 45.33 70.19 48.38   KR-15-11 107.66 99.26 37.03 1.72 11.28 24.46 22.00 22.06 30.06 46.49 46.49   KR-15-13 107.36 97.26 37.23 1.48 9.99 8.34 22.60 22.766 137.66 50.00 50.99 8.34 22.60 22.766 137.66 50.00 50.99 8.34 22.60 22.776 137.66 50.00 50.00 86.99 8.24 22.60 22.776 137.66 50.00 50.00 86.99 8.34 8.26 24.80 22.777 12.00 50.00 86.30 8.48 8.20 22.60 23.76 46.49 86.90 8.48 8.26 24.80 23.77 13.33 50.10 88.30 8.20 10.90 23.20 12.70 13.42 11.71 10.04 24.80 28.66 14.90 8	4.	KR-15-07	87.33	105.73	38.46	1.70	12.17	10.40	22.86	229.99	117.33	56.20	52.37	24.30	29.12
KR.15-11 107.66 99.06 35.00 170 11.28 8.68 24.46 212.66 32.06 49.95   KR.15-13 107.66 99.06 35.00 170 11.28 8.68 24.46 176 50.94 65.59   KR.15-15 116.00 99.26 31.73 148 10.66 23.00 23.36 146.00 50.94 65.59   KR.15-16 91.00 122.33 44.26 11.57 10.46 23.06 50.94 65.59   KR.15-17 14.33 10.23 37.56 15.6 11.71 10.46 22.00 23.56 14.08 49.30   KR.15-27 10.00 4.20 21.93 24.80 24.80 24.77 11.33 54.00 48.30   KR.15-28 10.50 99.80 32.75 11.71 10.06 24.80 24.82 24.82 24.82 24.82 24.82 24.82 24.82 24.82 24.82 24.82 24.82 24.82 24.82 <td>5.</td> <td>KR-15-09</td> <td>115.33</td> <td>107.86</td> <td>34.26</td> <td>1.71</td> <td>98.6</td> <td>7.84</td> <td>22.00</td> <td>236.11</td> <td>145.33</td> <td>70.19</td> <td>48.38</td> <td>18.51</td> <td>33.95</td>	5.	KR-15-09	115.33	107.86	34.26	1.71	98.6	7.84	22.00	236.11	145.33	70.19	48.38	18.51	33.95
KR15-13 107.33 97.26 31.73 1.48 9.80 8.34 22.60 216.88 137.66 63.06 46.49   KR-15-15 116.00 99.26 31.73 1.48 9.80 8.34 22.60 21.68 61.00 50.94 65.59   KR-15-16 91.00 122.33 44.26 1.53 9.94 8.66 23.00 23.77 12.133 50.85 50.10   KR-15-17 104.33 116.00 46.93 1.56 11.13 9.14 24.86 227.10 13.33 50.85 50.10 48.32   KR-15-20 105.63 195.40 3.66 1.56 11.13 9.14 24.86 27.70 12.133 50.85 50.00 44.32 KR-15-2 18.86 1.56 11.71 10.66 20.95 18.86 37.23 11.80 10.94 24.86 27.93 18.86 37.23 18.86 37.23 18.86 37.23 18.86 37.23 18.86 37.23 44	9.	KR-15-11	107.66	90.66	35.00	1.70	11.28	8.68	24.46	227.66	137.66	52.66	49.95	14.70	26.20
KR15-15 116.00 99.26 31.53 14.5 11.5 10.46 23.06 14.5 16.00 50.94 65.59   KR-15-16 91.00 122.33 44.26 13.53 14.4 10.66 92.00 23.06 257.70 14.33 50.94 65.59   KR-15-17 104.33 103.26 37.93 14.4 10.66 9.00 257.70 121.33 50.00 <t< td=""><td>۲.</td><td>KR-15-13</td><td>107.33</td><td>97.26</td><td>37.73</td><td>1.48</td><td>9.80</td><td>8.34</td><td>22.60</td><td>216.88</td><td>137.66</td><td>90.69</td><td>46.49</td><td>21.62</td><td>29.08</td></t<>	۲.	KR-15-13	107.33	97.26	37.73	1.48	9.80	8.34	22.60	216.88	137.66	90.69	46.49	21.62	29.08
KR-15-16 91.00 122.33 44.26 1.53 9.94 8.26 24.80 263.77 122.00 56.45 44.08   KR-15-17 104.33 103.26 37.93 1.44 10.66 9.00 23.60 13.33 50.85 50.40 48.33   KR-15-20 105.66 109.06 37.66 1.56 11.13 9.14 24.86 219.55 135.66 67.00 48.33   KR-15-21 106.56 99.80 32.73 1.47 11.04 24.86 219.55 135.66 57.00 48.33 57.74 44.33 50.06 48.33 57.74 44.33 50.06 48.33 57.74 44.33 50.06 48.33 57.74 44.33 50.06 48.33 50.06 57.44 44.33 50.06 57.44 47.33 50.06 57.44 47.33 50.06 57.44 47.33 50.06 57.44 47.33 50.06 57.44 47.33 50.06 57.44 47.33 50.06	8.	KR-15-15	116.00	99.26	31.53	1.45	11.57	10.46	23.00	233.66	146.00	50.94	62.29	21.50	31.96
KR-15-17 104-33 103-56 37-93 144 1066 9.00 23-60 134-33 50.85 50.10   KR-15-18 90.33 116.00 46.33 1.56 9.40 8.20 227-10 134-33 50.85 50.10   KR-15-20 105.66 109.06 46.33 1.56 1.76 11.71 10.06 24.80 247.77 121.33 54.00 48.32   KR-15-24 105.66 99.08 32.76 1.56 11.71 10.06 24.80 247.77 121.33 54.00 48.32   KR-15-25 106.00 107.60 37.06 1.52 82.6 7.93 23.56 47.80 47.80 47.80 47.80 47.80 47.80 47.80 47.80 47.80 47.80 47.80 47.80 47.80 47.80 47.80 47.80 47.81 47.81 47.81 47.81 47.81 47.81 47.81 47.81 47.81 47.81 47.82 47.81 47.82 <t< td=""><td>6</td><td>KR-15-16</td><td>91.00</td><td>122.33</td><td>44.26</td><td>1.53</td><td>9.94</td><td>8.26</td><td>24.80</td><td>263.77</td><td>122.00</td><td>56.45</td><td>44.08</td><td>14.20</td><td>24.92</td></t<>	6	KR-15-16	91.00	122.33	44.26	1.53	9.94	8.26	24.80	263.77	122.00	56.45	44.08	14.20	24.92
KR-15-18 90.33 116.00 46.93 156 94.0 8.20 21.93 24.77 121.33 54.00 48.30   KR-15-20 105.66 109.06 3.56 1.56 11.13 9.14 24.86 24.32 185.66 6.70 44.32   KR-15-21 106.33 99.66 199.80 32.73 1.47 12.68 10.17 22.93 189.66 129.66 29.97   KR-15-24 115.33 102.75 30.60 1.54 11.73 10.06 24.80 129.56 129.66 47.80 67.74   KR-15-26 106.33 106.80 1.54 11.73 10.13 24.93 53.56 136.6 27.93 189.66 12.94 32.34 44.77   KR-15-26 106.33 38.96 1.39 11.42 9.89 23.86 51.44 44.77   KR-15-29 89.00 1.43 1.00 39.96 1.39 1.42 53.33 58.66 51.42   KR-15-	10.	KR-15-17	104.33	103.26	37.93	1.44	10.66	9.00	23.60	227.10	134.33	50.85	50.10	20.37	25.49
KR-15-20 105.66 109.06 37.66 1.56 11.13 9.14 24.86 219.55 135.66 67.00 44.32   KR-15-21 106.33 95.40 36.86 1.56 11.71 10.06 24.80 219.55 67.00 44.32   KR-15-24 116.33 102.73 30.60 1.54 11.93 10.13 22.93 189.66 129.66 47.80 57.23   KR-15-24 116.30 107.60 37.06 1.54 11.93 10.13 24.93 23.15 142.66 82.66 25.97   KR-15-26 104.33 108.60 27.03 1.96 1.99 23.35 13.60 57.44 44.47   KR-15-27 106.33 89.80 28.06 1.39 11.42 989 23.33 10.44 44.47   KR-15-29 106.00 104.20 37.93 1.39 10.62 37.33 11.42 989 23.33 17.55 136.00 27.44   KR-15-29 <	<u></u>	KR-15-18	90.33	116.00	46.93	1.56	9.40	8.20	21.93	247.77	121.33	54.00	48.30	20.54	26.06
KR-15-21 106.33 95.40 36.86 1.50 11.71 10.06 24.80 243.22 136.33 62.86 37.23   KR-15-23 99.66 99.80 32.73 1.47 11.68 10.17 24.93 133.66 12.966 82.66 29.74   KR-15-25 106.00 107.60 37.06 1.54 11.93 10.17 24.93 233.66 12.966 82.66 29.97   KR-15-26 106.00 107.60 37.06 1.52 8.26 7.93 23.36 21.156 142.66 82.66 29.97   KR-15-27 106.33 108.86 1.52 11.17 10.04 25.00 142.60 32.37 32.46 42.21 32.37 32.47 44.47 44.47 44.47 44.47 44.47 44.47 44.47 44.47 44.47 44.47 44.47 44.47 44.47 44.47 44.47 44.47 44.44 44.73 44.90 44.90 44.47 44.44 44.44	12.	KR-15-20	105.66	109.06	37.66	1.56	11.13	9.14	24.86	219.55	135.66	67.00	44.32	20.36	29.27
KR-15-23 99.66 99.80 32.73 147 12.68 10.17 22.93 189.66 129.66 47.80 67.74   KR-15-24 115.33 102.73 30.60 1.54 11.93 10.13 24.93 23.36 12.66 47.80 67.74   KR-15-26 106.00 107.60 37.66 1.55 11.17 10.93 28.66 29.90 28.66 29.93 28.66 29.90 28.66 29.97 28.66 29.97 28.66 29.97 28.96 29.97 28.96 29.97 28.98 29.97 28.98 29.90 28.98 29.86 29.97 28.98 29.97 28.98 29.97 29.98 29.98 29.88 29.88 29.99 29.98 29.88 29.89 29.88 29.88 29.88 29.98 29.88 29.99 29.98 29.99 29.99 29.99 29.99 29.99 29.99 29.99 29.99 29.99 29.99 29.99 29.99 29.99	13.	KR-15-21	106.33	95.40	36.86	1.50	11.71	10.06	24.80	243.22	136.33	62.86	37.23	18.46	22.93
KR-15-24 115.33 102.73 30.60 154 1193 10.13 24.93 23.36 142.66 82.66 29.97   KR-15-25 106.00 107.60 37.06 15.2 8.26 7.93 23.35 231.55 136.00 32.37   KR-15-27 106.33 89.80 28.06 1.39 11.17 10.04 136.00 27.33 50.14 44.47   KR-15-28 89.00 104.20 37.93 1.39 10.62 8.26 23.33 177.55 119.66 42.21 59.85   KR-15-29 106.33 36.00 1.32 10.08 23.33 177.55 119.66 42.21 59.85   KR-15-30 108.00 104.33 36.00 1.32 10.08 23.00 21.56 42.21 59.85   KR-15-34 105.00 105.93 37.80 1.46 11.42 9.73 24.60 21.55 11.64 44.47   KR-15-34 105.00 105.93 37.80	4.	KR-15-23	99.66	99.80	32.73	1.47	12.68	10.17	22.93	189.66	129.66	47.80	67.74	18.96	32.06
KR-15-25 106.00 107.60 37.06 1.52 8.26 7.93 23.53 231.55 136.00 73.46 32.37   KR-15-26 106.00 107.60 37.06 1.52 8.26 7.93 23.53 231.55 136.00 73.46 32.37   KR-15-26 104.33 89.80 1.35 11.17 10.04 25.00 246.11 134.33 50.14 44.47   KR-15-29 106.30 104.33 39.60 1.35 12.01 22.63 215.55 118.63 50.14 44.47   KR-15-30 91.66 104.33 36.00 1.32 10.08 7.93 23.60 22.03 42.21 59.85   KR-15-30 91.66 104.33 36.00 1.32 10.08 7.93 23.60 22.09 44.47   KR-15-30 91.60 106.33 37.80 1.44 11.20 22.63 21.55 116.40 23.33 116.40 23.00 22.63 22.15 44.19	15.	KR-15-24	115.33	102.73	30.60	1.54	11.93	10.13	24.93	233.66	142.66	82.66	29.97	21.49	24.87
KR-15-26 104.33 108.86 37.53 1.35 11.17 10.04 25.00 246.11 134.33 50.14 44.47   KR-15-27 106.33 89.80 28.06 1.39 11.42 9.89 23.86 210.44 136.33 50.14 44.47   KR-15-29 106.03 104.20 37.93 1.39 10.62 8.26 22.63 215.55 119.66 60.62 48.24   KR-15-30 91.66 104.33 36.00 1.32 10.08 7.93 22.63 21.55 138.00 77.80 36.03   KR-15-31 86.33 102.13 38.46 1.44 13.26 10.66 23.00 221.99 121.66 60.62 48.54   KR-15-34 91.00 99.80 17.44 12.04 22.19 41.69 44.99   KR-15-35 91.00 99.80 17.56 91.8 24.73 195.44 11.53 51.40 44.99   KR-15-35 91.00 102.26	16.	KR-15-25	106.00	107.60	37.06	1.52	8.26	7.93	23.53	231.55	136.00	73.46	32.37	21.60	23.50
KR-15-27 106.33 89.80 28.06 1.39 11.42 9.89 23.86 210.44 136.33 58.86 51.42   KR-15-28 89.00 104.20 37.93 1.39 10.62 8.26 23.33 17.55 119.66 42.21 59.85   KR-15-29 106.00 109.33 39.60 1.55 12.93 12.03 215.55 118.00 77.80 36.03   KR-15-31 86.33 102.13 38.46 1.44 13.26 12.63 215.55 138.00 55.94 48.54   KR-15-34 91.00 99.06 37.33 1.46 11.42 9.73 24.60 213.77 135.00 55.94 44.99   KR-15-34 91.00 99.06 37.33 1.46 11.44 12.04 24.73 108.11 12.10 44.19   KR-15-34 91.00 99.06 37.33 1.46 11.44 12.04 24.73 108.11 12.10 44.99   KR-15-34 <	17.	KR-15-26	104.33	108.86	37.53	1.35	11.17	10.04	25.00	246.11	134.33	50.14	44.47	26.10	22.22
KR-15-28 89.00 104.20 37.93 1.39 10.62 8.26 23.33 177.55 119.66 42.21 59.85   KR-15-29 108.00 109.33 39.60 1.55 12.93 12.01 22.63 215.55 138.00 77.80 36.03   KR-15-30 91.66 104.33 36.00 1.32 10.08 7.93 23.60 221.99 121.66 42.21 59.03   KR-15-31 165.00 102.13 38.60 1.44 13.26 10.66 221.99 121.66 42.93 48.54   KR-15-34 91.00 99.06 37.33 1.46 11.42 24.73 24.60 213.70 45.94 44.16   KR-15-34 91.00 99.06 37.33 1.46 11.44 12.04 24.73 198.10 55.94 44.99   KR-15-34 91.00 99.06 37.40 1.43 12.06 23.20 214.21 12.00 45.43   KR-15-39 91.00	18.	KR-15-27	106.33	89.80	28.06	1.39	11.42	68.6	23.86	210.44	136.33	58.86	51.42	18.50	29.93
KR-15-29 108.00 109.33 39.60 1.55 12.93 12.01 22.63 215.55 138.00 77.80 36.03   KR-15-30 91.66 104.33 36.00 1.32 10.08 7.93 23.60 221.99 121.66 60.62 48.54   KR-15-31 86.33 102.13 38.46 1.44 13.26 10.66 23.00 233.33 116.6 60.62 48.54   KR-15-34 91.00 105.93 37.30 1.46 11.42 97.3 24.60 213.77 135.00 55.94 44.99   KR-15-34 91.00 99.06 37.33 1.46 14.44 12.04 24.73 208.11 12.10 65.39 44.16   KR-15-35 90.00 102.26 35.46 1.52 9.46 7.80 23.20 214.21 12.10 65.33 45.19   KR-15-39 91.00 99.80 34.00 1.43 12.06 25.60 204.44 12.10 47.34	19.	KR-15-28	89.00	104.20	37.93	1.39	10.62	8.26	23.33	177.55	119.66	42.21	59.85	20.09	24.88
KR-15-30 91.66 104.33 36.00 1.32 10.08 7.93 23.60 221.99 121.66 60.62 48.54   KR-15-31 86.33 102.13 38.46 1.44 13.26 10.66 23.03 116.33 55.22 52.37   KR-15-3 105.00 105.93 37.80 1.44 12.04 24.73 135.00 55.94 44.99   KR-15-34 91.00 99.06 37.33 1.46 14.44 12.04 24.73 135.00 55.94 44.99   KR-15-35 87.33 113.40 38.33 1.56 12.56 9.18 24.73 195.44 117.33 51.40 48.40   KR-15-37 90.00 102.26 34.40 1.25 9.46 7.80 23.20 24.42 17.33 47.54   KR-15-39 91.00 99.80 1.43 12.06 10.67 26.00 204.44 121.00 46.33 47.30   KR-15-43 98.00 107.80 <td< td=""><td>20.</td><td>KR-15-29</td><td>108.00</td><td>109.33</td><td>39.60</td><td>1.55</td><td>12.93</td><td>12.01</td><td>22.63</td><td>215.55</td><td>138.00</td><td>77.80</td><td>36.03</td><td>15.61</td><td>27.99</td></td<>	20.	KR-15-29	108.00	109.33	39.60	1.55	12.93	12.01	22.63	215.55	138.00	77.80	36.03	15.61	27.99
KR-15-3186.33102.1338.461.4413.2610.6623.00233.33116.3355.2255.2444.99KR-15-32105.00105.9337.801.4611.429.7324.60213.77135.0055.9444.99KR-15-3491.0099.0637.331.4614.4412.0424.73195.44117.3351.4048.40KR-15-3587.33113.4038.331.5612.569.4623.20214.21120.0047.5447.58KR-15-3991.0099.8034.0011.4312.0610.6726.00204.44117.0066.2345.19KR-15-41103.66100.0634.4011.3314.5012.80205.24131.0066.2344.30KR-15-4398.0097.6338.7314.5012.8022.50202.24131.0054.9344.30PHB-7182.00105.2436.6314.4911.509.7323.95225.08128.6160.1449.13Range lowest82.0089.8028.0613.017.8026.00298.53146.0083.7471.86C.D. (5%)6.1383.25.090.191.661.632.0049.504.9912.9213.67C.V.3.824.838.507.988.8510.2621.3713.4513.1417.03	21.	KR-15-30	91.66	104.33	36.00	1.32	10.08	7.93	23.60	221.99	121.66	60.62	48.54	17.69	29.06
KR-15-32105.00105.9337.801.4611.429.7324.60213.77135.0055.9444.99KR-15-3491.0099.0637.331.4614.4412.0424.73208.11121.0065.1944.16KR-15-3587.33113.4038.331.5612.569.1824.73195.44117.3351.4048.40KR-15-3790.00102.2635.461.529.467.8023.20214.21120.0047.5447.58KR-15-3991.0099.8034.001.4312.0610.6726.00204.44121.0066.2345.19KR-15-41103.66102.0634.401.3314.5012.8020.24121.0066.2344.30KR-15-4398.0097.6336.061.4010.298.4022.80202.24131.0054.9344.30PHB-7182.00107.8038.731.5412.0011.0025.06298.53119.3348.6671.86Mean98.20105.2436.631.7114.5012.8026.00298.53146.0083.7471.86Range lowest82.0089.8028.061.308.267.8021.93175.33115.6642.2129.97C.D. (5%)6.138.325.090.191.661.6320.049.504.9912.9213.67C.V.3.824.8310.265.12<	22.	KR-15-31	86.33	102.13	38.46	1.44	13.26	10.66	23.00	233.33	116.33	55.22	52.37	23.45	28.67
KR-15-3491.0099.0637.331.4614.4412.0424.73208.11121.0065.1944.16KR-15-3587.33113.4038.331.5612.569.1824.73195.44117.3351.4048.40KR-15-3790.00102.2635.461.529.467.8023.20214.21120.0047.5447.58KR-15-3991.0099.8034.001.4312.0610.6726.00204.44121.0066.2345.19KR-15-41103.66102.0634.401.3314.5012.8020.224131.0054.9344.30KR-15-4398.0097.6336.061.4010.298.4022.80202.24131.0054.9344.30PHB-7182.00107.8038.731.5412.0011.0025.06298.53119.3348.6671.86Mean98.20105.2436.631.7114.5012.8026.00298.53146.0083.7471.86Range lowest82.0089.8028.061.308.267.8021.93175.33115.6642.2129.97C.D. (5%)6.138.3510.265.1213.452.3713.1417.03	23.	KR-15-32	105.00	105.93	37.80	1.46	11.42	9.73	24.60	213.77	135.00	55.94	44.99	22.41	24.90
KR-15-3587.33113.4038.331.5612.569.1824.73195.44117.3351.4048.40KR-15-3790.00102.2635.461.529.467.8023.20214.21120.0047.5447.58KR-15-3991.0099.8034.001.4312.0610.6726.00204.44121.0066.2345.19KR-15-41103.66102.0634.401.3314.5012.8025.66175.33133.6646.6461.56KR-15-4398.0097.6336.061.4010.298.4022.80202.24131.0054.9344.30PHB-7182.00107.8038.731.5412.0011.0025.06298.53119.3348.6671.86Mean98.20105.2436.631.7114.509.7323.95225.08128.6160.1449.13Range lowest82.0089.8028.061.308.267.8021.93175.33115.6642.2129.97C.D. (5%)6.138.325.090.191.661.6320.049.504.9912.9213.67C.V.3.824.838.507.988.8510.265.1213.452.3713.1417.03	24.	KR-15-34	91.00	90.66	37.33	1.46	14.44	12.04	24.73	208.11	121.00	65.19	44.16	22.28	28.49
KR-15-3790.00102.2635.461.529.467.8023.20214.21120.0047.5447.58KR-15-3991.0099.8034.001.4312.0610.6726.00204.44121.0066.2345.19KR-15-41103.66102.0634.401.3314.5012.8025.66175.33133.6646.6461.56KR-15-4398.0097.6336.061.4010.298.4022.80202.24131.0054.9344.30PHB-7182.00107.8038.731.5412.0011.0025.06298.53119.3348.6671.86Mean98.20105.2436.631.4911.509.7323.95225.08128.6160.1449.13Range lowest82.0089.8028.061.308.267.8021.93175.33115.6642.2129.97C.D. (5%)6.138.325.090.191.661.632.0049.504.9912.9213.67C.V.3.824.838.507.988.8510.265.1213.452.3713.1417.03	25.	KR-15-35	87.33	113.40	38.33	1.56	12.56	9.18	24.73	195.44	117.33	51.40	48.40	21.45	24.94
KR-15-3991.0099.8034.001.4312.0610.6726.00204.44121.0066.2345.19KR-15-41103.66102.0634.401.3314.5012.8025.66175.33133.6646.6461.56KR-15-4398.0097.6336.061.4010.298.4022.80202.24131.0054.9344.30PHB-7182.00107.8038.731.5412.0011.0025.06298.53119.3348.6671.86Mean98.20105.2436.631.4911.509.7323.95225.08128.6160.1449.13Range lowest82.0089.8028.061.308.267.8021.93175.33115.6642.2129.97C.D. (5%)6.138.325.090.191.661.632.0049.504.9912.9213.67C.V.3.824.838.507.988.8510.265.1213.452.3713.1417.03	26.	KR-15-37	00.06	102.26	35.46	1.52	9.46	7.80	23.20	214.21	120.00	47.54	47.58	22.82	22.54
KR-15-41103.66102.0634.401.3314.5012.8025.66175.33133.6646.6461.56KR-15-4398.0097.6336.061.4010.298.4022.80202.24131.0054.9344.30PHB-7182.00107.8038.731.5412.0011.0025.06298.53119.3348.6671.86Mean98.20105.2436.631.4911.509.7323.95225.08128.6160.1449.13Range highest116.00122.3346.931.7114.5012.8026.00298.53146.0083.7471.86Range lowest82.0089.8028.061.308.267.8021.93175.33115.6642.2129.97C.D. (5%)6.138.325.090.191.661.632.0049.504.9912.9213.67C.V.3.824.838.507.988.8510.265.1213.452.3713.1417.03	27.	KR-15-39	91.00	99.80	34.00	1.43	12.06	10.67	26.00	204.44	121.00	66.23	45.19	27.90	29.78
KR-15-43 98.00 97.63 36.06 1.40 10.29 8.40 22.80 202.24 131.00 54.93 44.30   PHB-71 82.00 107.80 38.73 1.54 12.00 11.00 25.06 298.53 119.33 48.66 71.86   Mean 98.20 105.24 36.63 1.49 11.50 9.73 23.95 225.08 128.61 60.14 49.13   Range highest 116.00 122.33 46.93 1.71 14.50 12.80 26.00 298.53 146.00 83.74 71.86   Range lowest 82.00 82.6 7.80 21.93 175.33 115.66 42.21 29.97   C.D. (5%) 6.13 8.32 5.09 0.19 1.66 1.63 2.00 49.50 4.99 12.92 13.67   C.V. 3.82 4.83 8.50 7.98 8.85 10.26 5.12 13.45 2.37 13.14 17.03	28.	KR-15-41	103.66	102.06	34.40	1.33	14.50	12.80	25.66	175.33	133.66	46.64	61.56	17.57	28.46
PHB-71 82.00 107.80 38.73 1.54 12.00 11.00 25.06 298.53 119.33 48.66 71.86   Mean 98.20 105.24 36.63 1.49 11.50 9.73 23.95 225.08 128.61 60.14 49.13   Range highest 116.00 122.33 46.93 1.71 14.50 12.80 26.00 298.53 146.00 83.74 71.86   Range lowest 82.00 89.80 1.30 8.26 7.80 21.93 175.33 115.66 42.21 29.97   C.D. (5%) 6.13 8.32 5.09 0.19 1.66 1.63 2.00 49.50 4.99 12.92 13.67   C.V. 3.82 4.83 8.50 7.98 8.85 10.26 5.12 13.45 2.37 13.14 17.03	29.	KR-15-43	98.00	97.63	36.06	1.40	10.29	8.40	22.80	202.24	131.00	54.93	44.30	24.23	24.21
98.20 105.24 36.63 1.49 11.50 9.73 23.95 225.08 128.61 60.14 49.13 highest 116.00 122.33 46.93 1.71 14.50 12.80 26.00 298.53 146.00 83.74 71.86 lowest 82.00 89.80 28.06 1.30 8.26 7.80 21.93 175.33 115.66 42.21 29.97 (5%) 6.13 8.32 5.09 0.19 1.66 1.63 2.00 49.50 4.99 12.92 13.67 3.82 4.83 8.50 7.98 8.85 10.26 5.12 13.45 2.37 13.14 17.03	30.	PHB-71	82.00	107.80	38.73	1.54	12.00	11.00	25.06	298.53	119.33	48.66	71.86	22.13	34.56
ge highest 116.00 122.33 46.93 1.71 14.50 12.80 26.00 298.53 146.00 83.74 71.86 ge lowest 82.00 89.80 28.06 1.30 8.26 7.80 21.93 175.33 115.66 42.21 29.97 (5%) 6.13 8.32 5.09 0.19 1.66 1.63 2.00 49.50 4.99 12.92 13.67 3.82 4.83 8.50 7.98 8.85 10.26 5.12 13.45 2.37 13.14 17.03		Mean	98.20	105.24	36.63	1.49	11.50	9.73	23.95	225.08	128.61	60.14	49.13	20.80	28.71
ge lowest 82.00 89.80 28.06 1.30 8.26 7.80 21.93 175.33 115.66 42.21 29.97 . . (5%) 6.13 8.32 5.09 0.19 1.66 1.63 2.00 49.50 4.99 12.92 13.67 0 . 3.82 4.83 8.50 7.98 8.85 10.26 5.12 13.45 2.37 13.14 17.03		Range highest	116.00	122.33	46.93	1.71	14.50	12.80	26.00	298.53	146.00	83.74	71.86	27.90	43.36
. (5%) 6.13 8.32 5.09 0.19 1.66 1.63 2.00 49.50 4.99 12.92 13.67 3.82 4.83 8.50 7.98 8.85 10.26 5.12 13.45 2.37 13.14 17.03		Range lowest	82.00	89.80	28.06	1.30	8.26	7.80	21.93	175.33	115.66	42.21	29.97	14.20	22.22
3.82 4.83 8.50 7.98 8.85 10.26 5.12 13.45 2.37 13.14 17.03		C.D. (5%)	6.13	8.32	5.09	0.19	1.66	1.63	2.00	49.50	4.99	12.92	13.67	0.98	5.97
		C.V.	3.82	4.83	8.50	7.98	8.85	10.26	5.12	13.45	2.37	13.14	17.03	2.90	12.73

Table 3: Estimation of components of variance and genetic parameters for 13 characters in rice germplasm

characters	Vg	>°	Coefficient of variation PCV (%)	ariation GCV (%)	h² (bs)(%)	CA	GA as (%)
Days to 50% flowering	99.73	113.85	10.86	10.17	87.60	19.25	19.60
Plant height	44.14	20.06	7.95	6.31	63.00	10.86	10.32
Flag leaf length	9.65	19.37	12.01	8.48	49.80	4.52	12.33
Flag leaf width	900.0	0.02	09.6	5.33	30.90	0.09	6.11
Numbers of tillers per plant	1.99	3.03	15.14	12.29	65.80	2.36	20.54
Number of panicles per plant	1.65	2.65	16.71	13.19	62.30	2.08	21.44
Panicle length	0.72	2.23	6.23	3.55	32.50	1.00	4.17
Number of spikelets per panicle	340.52	1258.13	15.75	8.19	27.10	19.77	8.78
Days to maturity	89.94	99.26	7.74	7.37	09.06	18.59	14.45
Biological yield per plant	108.25	170.78	21.72	17.29	63.40	17.06	28.37
Harvest index	65.86	135.89	23.72	16.51	48.50	11.64	23.69
Test weight	9.56	9.92	15.14	14.86	96.30	6.25	30.05
Seed yield per plant	22.04	35.42	20.73	16.35	62.20	7.63	26.58

 $V_g$  = genotypic variation,  $v_p$  phenotypic variation, GCV = Genotypic coefficient of variation, PCV = Phenotypic coefficient of variation,  $v_p$  phenotypic variation,  $v_p$  henotypic variation,  $v_p$  because  $v_p$  and  $v_p$  henotypic variation,  $v_p$  because  $v_p$  b

Table 4: Estimation of Genotypic correlation coefficient between yield and its related traits in 30 rice genotypes

S.no	S.no Characters	Days to	Plant	Flag	Flag	Tillers/	Panicles/	Panicle	No.of	Days to	Biological	Harvest	Test	Seed
		20%	height	leaf	leaf	plant	plant	length	spikelets	maturity	yield /	index	weight	yield /
		flowering		length	width				/panicle		plant			plant
<del>.</del>	Days to 50% flowering 1.00	1.00	-0.41*	-0.47*	0.23**	-0.23*	-0.11	-0.15	-0.20*	**66.0	0.14	-0.36*	-0.30*	-0.31
2.	Plant height		1.00	0.69**	0.13	0.005	0.007	0.05	0.62	-0.42*	0.36**	-0.08	-0.08	0.35
3.	Flag leaf length			1.00	0.05	-0.22*	-0.25*	-0.39*	0.38	-0.45*	-0.10	-0.22*	-0.06	-0.25
4.	Flag leaf width				1.00	-0.31*	-0.32*	-0.71*	0.37**	0.24**	0.19	-0.31*	-0.33*	-0.10
5.	Tillers /plant					1.00	0.95	0.60	-0.29*	-0.26*	0.12	0.32**	60.0	0.43
9.	Panicles/plant						1.00	0.62**	-0.11	-0.12	0.27**	0.25*	0.15	0.49
۲.	Panicle length							1.00	90.0	-0.17	0.23 **	-0.27*	0.19	0.001
8.	No. of spikelets /panicle								1.00	-0.13	0.34**	-0.01	90.0	0.39
9.										1.00	0.10	-0.30*	-0.30*	-0.30
10.	Biological yield /plant										1.00	-0.56*	0.01	0.48
1.	Harvest index											1.00	-0.002	0.43
12.	Test weight												1.00	0.04

Table 5: Estimation of Phenotypic correlation coefficient between yield and its related traits in 30 rice genotypes

S.no	S.no Characters	Days to 50% flowering	Plant height	Flag leaf length	Flag leaf width	Tillers/ plant	s/ Panicles/ plant	Panicle Iength	No.of spikelets /panicle	Days to maturity	Biological yield / plant	Harvest index	Test weight	Seed yield / plant
<b>←</b>	Days to 50% flowering 1.00	1.00	-0.41*	-0.39*	0.03	-0.18	-0.13	-0.18	-0.13	0.98**	0.12	-0.27*	-0.26*	-0.24
2.	Plant height		1.00	0.58**	0.16	-0.07	-0.05	0.11	0.30	-0.40*	0.15	-0.01	-0.08	0.20
3.	Flag leaf length			1.00	0.23 **	-0.16	-0.11	0.004	0.29	-0.36*	-0.15	-0.02	-0.07	-0.12
4.	Flag leaf width				1.00	-0.19	-0.21*	0.08	0.17	0.05	0.05	-0.02	-0.17	0.02
5.	Tillers /plant					1.00	0.86**	0.22 **	-0.05	-0.19	0.14	0.23 **	0.08	0.40
9	Panicles/plant						1.00	0.25 **	0.07	-0.12	0.17	0.19	0.10	0.37
7.	Panicle length							1.00	60.0	-0.18	0.01	0.11	0.05	0.12
89	No. of spikelets /panicle								1.00	-0.09	0.20	-0.008	-0.01	0.19
9.	Days to maturity									1.00	0.08	-0.21*	-0.27*	-0.22
10.	Biological yield /plant										1.00	-0.57*	0.02	0.40
1.	Harvest index											1.00	-0.01	0.47
12.	Test weight												1.00	0.03

Table 6: Estimation of direct and indirect effects of yield related traits on seed yield in 30 rice genotypes at phenotypic level

S.No	No Characters	Days to 50% flowering	Plant Height (cm)	Flag Leaf length (cm)	Flag Leaf width (cm)	Tillers/ plant	Panicle/ plant	Panicle length (cm)	Spikelets/ panicle	Days to Maturity	Biological Yield (gm)	Harvest Index (%)	Test Weight (gm)	Seed yield/ plant(gm)
<del> </del>	Days to 50% flowering	0.04	-0.02	-0.01	0.001	-0.008	-0.006	-0.009	900.0-	0.04	900.0	-0.01	-0.01	-0.24
2.	Plant Height (cm)	-0.01	0.04	0.02		-0.003	-0.002	0.002	0.01	-0.01	900.0	-0.0006	-0.003	0.20
3.	Flag Leaf length (cm)	-0.001	0.002	0.004		-0.0007	-0.0005	0.00	0.001	-0.001	9000'0-	-0.0001	-0.0003	-0.12
4.	Flag Leaf width (cm)	0.00	0.00	0.00	_	0.00	0.00	0.00	0.00	0.00	00.00	0.00	00.00	0.02
5.	Tillers/ plant	-0.009	-0.003	-0.008		0.04	0.04	0.01	-0.002	-0.009	0.007	0.01	0.004	0.40
9.	Panicle/ plant	900.0	0.002	0.005		-0.04	0.04	-0.01	-0.003	900.0	-0.008	-0.009	-0.005	0.37
۲.	Panicle length (cm)	0.005	-0.003	-0.0001		-0.006	-0.007	-0.02	-0.002	0.005	-0.0004	-0.003	-0.001	0.12
ω.	Spikelets/ panicle	0.001	-0.002	-0.002		0.0004	-0.0005	-0.0006	0.007	0.0006	-0.001	0.0001	0.0001	0.19
9.	Days to Maturity	-0.117	0.04	0.04		0.02	0.01	0.02	0.01	-0.12	-0.01	0.02	0.03	-0.22
10.	Biological Yield (gm)	0.12	0.15	-0.15		0.14	0.17	0.01	0.20	0.08	1.006	-0.57	0.02	0.40
11.	Harvest Index (%)	-0.28	-0.01	-0.02		0.24	0.20	0.12	-0.008	-0.22	-0.59	1.04	-0.01	0.47
12.	Test Weight (gm)	-0.003	-0.001	-0.001		0.001	0.001	0.0007	-0.0002	-0.003	0.0003	-0.0002	0.01	0.03

R SQUARE = 0.9109 RESIDUAL EFFECT = 0.2986

Table 7: Estimates of direct and indirect effects of yield related traits on seed yield in 30 rice genotypes at genotypic level.

.No	.No Characters	Days to	Plant		Flag Leaf	Tillers/	Panicle/	Panicle	Spikelets/	Days to	Biological			Seed
		50% flowering	Height (cm)	length (cm)	width (cm)	_		length (cm)	panicle	Maturity	, Yield (gm)	Index (%)	Weight (gm)	yield/plant (gm)
	Days to 50% flowering	1.09	-0.45		0.25			-0.17	-0.22		0.15			-0.31
2.	Plant Height (cm)	-0.21	0.52	0.36	0.07	0.002	0.003	0.02	0.32	-0.22	0.19			0.35
3.	Flag Leaf length (cm)	0.24	-0.35		-0.02	_		0.20	-0.20		0.05			-0.25
4.	Flag Leaf width (cm)	90.0	0.03		0.27			-0.19	0.10		0.05			-0.10
5.	Tillers/ plant	0.56	-0.01		0.75			-1.47	0.70		-0.29			0.43
9	Panicle/ plant	-0.26	0.01		-0.77			1.46	-0.26		0.64			0.49
7.	Panicle length (cm)	-0.002	0.0007		-0.009			0.01	6000.0		-0.003			0.001
8.	Spikelets/panicle	0.08	-0.24		-0.14			-0.02	0.38		-0.13			0.39
9.	Days to Maturity	-1.74	0.74		-0.42	_		0.29	0.22		-0.17			-0.30
10.	Biological Yield (gm)	0.05	0.14		0.07			0.09	0.13		0.40			0.48
<u>-</u>	Harvest Index (%)	-0.26	-0.06		-0.22	_		-0.19	-0.01		-0.40			0.43
2.	Test Weight (gm)	0.05	0.01		90.0			-0.03	-0.01		-0.003			0.04
Š	SOLIARE = 0 9260: RESIDITIAL EFFECT = 0 2721	T = 0 2721												

per plant (0.37) were found significant and positive association with seed yield per plant at phenotypic level. Bhadru et al. (2011), Paul et al. (2011), Datt et al. (2012) and pandey et al. (2012) were reported that there is positive significant correlation between biological yield per plant and harvest index with seed yield at phenotypic level. The result of phenotypic correlation coefficient between yield and its related traits present in the table5. In the present investigation path coefficient analysis has been conducted for seed yield per plant. Harvest index (1.04), biological yield per plant (1.006), number of tillers per plant (0.04), number of panicles per plant (0.04), plant height (0.04), days to 50% flowering (0.04), test weight (0.01), number of spikelets per panicle (0.007) and flag leaf length (0.004) were found significant and positive association with seed yield at phenotypic level. The result of direct and indirect effects of yield related traits on seed yield at phenotypic level present in table6. Number of tillers per plant (2.41), number of panicles per plant (2.33), days to 50% flowering (1.09), harvest index (0.72), plant height (0.52), biological yield per plant (0.40), number of spikelets per panicle (0.38), flag leaf width (0.27) and panicle length (0.01) showed positive and significant association with seed yield per plant at genotypic level. Similar result was also reported by Ishwar et al. (2012) and Neha and Lal (2012). The result of direct and indirect effects of yield related traits on seed yield at genotypic level present in table 7. These traits contributed maximum to higher seed yield compared to other characters, thus, selection for these characters helps in selection of superior fine genotypes.

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