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SELECTION OF MID MATURITY DURATION ELITE LINES OF RICE IN SOME CROSSES OF SWARNA

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Abstract

Experiment was conducted during *Kharif* 2010 at Research cum Instructional Farm of IGKV, Raipur (C.G.), India. Thirty five elite lines (F_6) from four crosses Swarna × Phalguna, Swarna × Abhaya, Swarna × Jhitpiti and Swarna × RP 2333 were selected. These were evaluated for different yield contributing traits with emphasis to maturity (mid early) duration, grain characters and yielding ability similar to Swarna. Significant variability for days to 50% flowering, days to maturity, plant height, number of tillers per plant, panicle length, grain yield, test weight, hulling percentage, length of hulled seed, breadth of hulled seed, milling percentage, kernel length, kernel width, kernel length width ratio, test weight ratio, test weight of milled rice, head rice recovery and broken rice percentage was recorded. Correlation and path analysis indicated that grain yield per hectare can be increased directly by selection based on plant height, panicle length, number of tillers per plant, days to maturity and test weight. The selected elite lines from cross no's 5, 19 and 22 having maturity duration ranges from 126-130 days with yield at par as well as higher than Swarna.

Key words : Rice, Swarna, correlation, path analysis and multiple regression analysis.

Introduction

Swarna is the most popular rice variety and widely grown by in Chhattisgarh, Andhra Pradesh, Orissa, West Bengal and other rice growing states of India. Despite of its late maturity (140 days) and susceptibility to many pests and diseases, it has unique yielding ability and quality rice fetching high premium in the market and therefore this variety is still grown in areas where water is available. In this variety, active tillering period is from 45 days after transplanting to 120 days after transplanting, if some tillers are affected due to diseases or insect infestation new tillers compensate the yield losses. But due to late maturity the variety is harvested late due to which the sowing of *rabi* crop in the next season is drastically affected (Rao *et al*., 2001). If the maturity duration of this variety can be reduced upto 120-125 days, this will be great achievement for the farmers. By keeping this in view early maturing parents are selected and crosses were made with Swarna. Elite lines from these crosses were selected having mid-early maturity and grain quality similar to Swarna.

Materials and Methods

Four parents from mid maturity group *i.e*., Phalguna (120 days), Abhya (125 days), RP 2333 (125 days) and Jhitpiti (120 days) were crossed with Swarna, in order to selection of material for mid maturity with similar grain type as Swarna. Thirty four elite selections with mid maturity group were made from following four crosses since F_2 generation and advanced upto F_6 generation and evaluated for yield and yield contributing traits between 2008-2011 at Indira Gandhi Krishi Vishwavidyalaya, Raipur (C.G.), India.

Seventeen morphological characters included ancillary characters, plant characters and grain characters were studied. Statistical analysis was performed to study genetic variability, correlation and path analysis.

Results and Discussion

Genetic enrichment of a crop, either through direct improvement of a character in which breeder is interested or in direct improvement through component characters can be achieved effectively on the basis of sound genetic information. In order to meet the ultimate goal of high yield of quality seed, investigation on the presence of genetic variability for grain yield, its component characters and the nature of association among themselves is prerequisite of any breeding programme.

The data recorded on various traits were subjected to statistical analysis which showed presence of significant variance due to genotypes for plant height, head rice

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recovery, broken rice, days to 50% flowering, days to maturity, hulling, grain yield, panicle length, number of tillers per plant and kernel length (table 1). Phenotypic variance were higher in magnitude than genotypic variances for all characters except test weight and breadth of milled rice, test weight of milled rice and kernel length and breadth. The highest genotypic variance was obtained for number of tillers per plant, followed by head rice recovery percentage, broken rice percentage, days to 50% flowering, days to maturity and hulling percentage. However, low genotypic variance was recorded for kernel breadth, test weight of milled rice and breadth of hulled seed. This showed the presence of variability in the material studied, which could be exploited for indicates the better chances of selecting better material. Significant variability present in all the characters in the materials due to genotypes indicated better scope for selection. This finding is in agreement with the findings of Medhi *et al*. (2004) and Bisene *et al*. (2007).

Among the yield components at phenotypic level, kernel breadth (0.300), showed the maximum direct effect on grain yield, kernel breadth had positive indirect effect on breadth of hulled seed (0.042), test weight of milled rice (0.040), head rice recovery (0.022) and hulling percentage (0.01) (table 2).

Length of hulled rice had positive direct effect (0.239) on grain yield per plant with positive indirect effect via; test weight of milled rice (0.064), kernel length (0.052), plant height (0.036), head rice recovery (0.034) and hulling percentage (0.032), but negative indirect effect through broken rice percentage (-0.06) and panicle length (-0.024).

Direct effect of days to maturity (0.224) on grain yield was positive with positive indirect effect via; days to 50% flowering (0.058), milling percentage (0.019), length of hulled seed (0.018) and number of tillers per plant (0.01), whereas negative indirect effect through hulling percentage (-0.058), breadth of hulled seed (-0.055), kernel length (-0.028) and panicle length (-0.026).

Direct effect of broken rice percentage (0.193), on grain yield was positive, with positive indirect effect via, plant height (0.06), test weight (0.035), whereas negative indirect effect via; head rice recovery (-0.104) and 50 percentage days to flowering (-0.073), length of hulled seed (-0.049), number of tillers (-0.021), test weight of milled rice (-0.018), kernel breadth (-0.017).

Kernel breadth, length of hulled seed, days to maturity, broken rice percentage, panicle length, kernel L/B ratio, milling percentage, head rice recovery, number of tillers per plant and test weight of milled rice have positive correlation as well as direct effect on grain yield reveals true relationship between these characters with grain yield and direct selection for these traits will be rewarding for yield improvement. Whereas, negative correlation of days to 50 per cent flowering, plant height, breadth of hulled seed, kernel length and hulling percentage with grain yield along with negative direct effect of these characters on grain yield indicates that selection based on such traits may reduce the yield, hence selection based on these traits should be avoided. This finding also confirms the findings of previous workers Reuben and Katuli (1988),

Table 1 : Mean sum of squares for different characters of rice.

Source of variance	D.F.	Characters								
		Days to 50% flowering	Days to maturity	Plant height (cm)	Number of tillers per plant	Panicle length (cm)	Test weight (g)	Hulling percentage	Length of hulled seed (cm)	Breadth of hulled seed (cm)
Rep.	2	18.00**	15.50*	5.56*	0.26	2.46**	7.72*	1.68	0.14	2.43
Gen.	34	60.51**	45.19**	124.44**	4.14**	6.99**	0.33	41.52**	1.28**	0.12
Err.	68	4.00	4.78	2.22	0.23	0.62	2.84	1.81	0.16	2.29

S.V.	D. F.	Characters							
		Milling percentage	Kernel length (cm)	Kernel breadth (cm)	Kernel length breadth ratio (cm)	Test weight of milled rice (g)	Head rice recovery percentage	Broken rice percentages	Grain yield (Q\ha)
Rep.	2	3.28	0.49**	6.25*	5.50	3.50	4.11	7.91	0.60
Gen.	34	9.33	1.49**	0.10	0.31	5.12	111.71**	95.52**	28.74**
Err.	68	4.69	0.13	1.98	7.35	25.20	8.26	12.27	7.21

** Significant at 1% level * Significant at 5% level.

Table 2 : Genotypic path coefficient analysis showing direct and indirect effect of different yield contributing characters on grain yield in F_6 generations in crosses of rice.

Characters	X_1	X_2	X_3	X_4	X_5	X_6	X_7	X_8	X_9	X_{10}	Correlation coefficient
X_1	**0.528**	0.008	-0.025	0.151	-0.214	-0.033	0.000	0.060	-0.064	-0.160	0.333
X_2	0.019	**0.214**	0.011	-0.057	0.199	-0.134	0.018	0.106	0.039	-0.206	0.148
X_3	-0.062	0.011	**0.212**	-0.187	0.142	-0.101	0.024	0.057	-0.293	0.222	0.020
X_4	0.059	-0.009	-0.029	**1.356**	0.241	-0.004	0.037	-0.202	0.201	-0.649	0.309
X_5	0.133	0.050	-0.035	0.385	**0.848**	-0.019	0.052	0.046	0.573	-0.098	0.591**
X_6	-0.032	-0.053	-0.040	-0.011	0.030	**0.536**	-0.136	-0.109	0.237	-0.137	0.323
X_7	0.054	0.027	0.035	0.344	-0.306	-0.468	**0.144**	0.038	0.066	0.023	-0.079
X_8	-0.055	-0.040	-0.021	0.482	0.069	0.103	-0.010	**-0.568**	0.064	-0.175	0.020
X_9	-0.027	0.007	-0.050	0.221	-0.393	0.103	0.008	-0.029	**1.236**	-1.379	-0.079
X_{10}	-0.046	-0.024	0.025	-0.475	0.045	-0.040	0.002	0.054	-0.920	**1.852**	0.193

Residual effect = 0. 2277

X_1- Days to maturity, X_2- Number of tillers per plant, X_3- Panicle length (cm), X_4- Length of hulled seed (cm), X_5- Milling percentage X_6- Kernel breadth (cm), X_7- Kernel L/B ratio, X_8- Test weight of milled rice (g), X_9- Head rice recovery, X_{10}- Broken rice percentage, X_{11}- Kernel length (cm).

Table 3 : Multiple regression analysis.

Multiple regression equation	Coefficient of determination (R^2) percentage	Multiple correlation coefficient (R)
$Y = -0.178X_1 + 0.211X_2 + 0.485X_4 + 0.164X_5 + 1.149X_8 + 0.243X_{10} + 3.780X_{12} + 0.074X_{16}$	26.89	0.5186**
$Y = -0.170X_1 + 0.203X_2 + 0.501X_4 + 1.130X_8 + 0.242X_{10} + 3.775X_{12} + 0.081X_{16}$	26.60	0.5138**
$Y = -0.214X_1 + 0.219X_2 + 0.451X_4 + 0.974X_8 + 0.241X_{10} + 3.386X_{12}$	24.98	0.4998**
$Y = -0.215X_1 + 0.224X_2 + 0.991X_8 + 0.264X_{10} + 2.870X_{12}$	22.92	0.4787**
$Y = -0.240X_1 + 0.229X_2 + 1.031X_8 + 0.261X_{10}$	20.24	0.4499**
$Y = -0.245X_1 + 0.243X_2 + 1.099X_8$	17.30	0.4159**

Where, Y = Grain yield.

X_1- Days to 50 percentage flowering
X_2- Days to maturity
X_3- Plant height (cm)
X_4- Number of tillers per plant
X_5 - Panicle length (cm)
X_6 - Test weight (g)
X_7 - Hulling percentage
X_8-Length of hulled seed (cm)
X_9 - Breadth of hulled seed (cm)
X_{10} - Milling percentage
X_{11} - Kernel length (cm)
X_{12}-Kernel breadth (cm)
X_{13} - Kernel L/B ratio
X_{14}-Test weight of milled rice (g)
X_{15}-Head rice recovery percentage
X_{16} - Broken rice percentage

Rema Bai *et al*. (1992), Kotch *et al*. (1993), Rao and Shrivastava (1994), Chauhan (1996), Sarawagi *et al*. (1997).

Multivariate linear regression was estimated by working out the multiple regression equation, coefficient of determination. Multiple correlation coefficients of different variables by taking grain yield as dependent variable were analyzed. The best regression equation for grain yield accounted 27.52 per cent. It involve days to 50% flowering, days to maturity, number of tillers per plant, panicle length, length of hulled seed, breadth of hulled seed, milling percent, kernel breadth and broken rice percentage. Shrivastava and Sharma (1971) and Paramasivan and Shreerangasamy (1988), also reported similar finding in their studies.

Multiple regression equation indicate the above analysis crosses 5, 19 and 27 showed desirable types fitted with objectives. The maturity of Swarna is nearly 140 days. The selected lines 5, 19 and 27 having the maturity duration between 126-130 days, which fulfill the objective of study. Hence the lines selected from crosses 5, 19 and 27 are having improvement over Swarm (table 3).

Identification of elite lines over Swarma

Path coefficient analysis showed direct effect and indirect effect of independent variables on dependent variables *i.e.* effect of yield contributing traits on grain yield, days to maturity, number of tillers per plant, test weight, length of hulled seed, milling percentage, kernel breadth, test weight of milled rice and head rice recovery exhibited positive correlation with seed yield simultaneously also showed direct positive effect of there characters on seed yield cleanly indicating their influence on seed yield, direct selection through these traits will be effective in improving the seed yield per plant.

Days to maturity, number of tillers per plant, test weight is most important attributes to consider for improvement of seed yield per plant, because days to maturity and number of tillers per plant contributes maximum indirect effect via test weight, kernel length, kernel breadth and number of grains per panicle.

Above result confirm with the findings of Rema *et al*. (1992), Shivani and Reddy (2000), Anna (2001), Babu and Reddy (2002), Satish *et al*. (2003) and Naik *et al*. (2005).

Association analysis indicated that grain yield largely dependent on characters mainly responsible for conversion of source *i.e.* solar energy into chemical forms via days to maturity, plant height, number of tillers up to a large extent. The chemical energy thus stored in economic sink *i.e.* number of spikes per panicle, kernel length and breadth. These types of plants will be able to produce maximum seed yield due to good source and sink relationship. Positive direct effects of these characters also support it. In multiple regression analysis variables days to maturity, number of tillers per plant, panicle length and test weight contributed maximum towards grain Yield. This indicated the genotypes hawing better values for days to maturity, number of tillers per plant, panicle length and test weight will have more grain yield.

Keeping in view above finding, progenies of the cross 5, 19 and 27 were fond better over Swarna and other progenies evaluated in this study. Since, progenies of cross 5 having 134 days to maturity, 9.67 tillers per plant, 26.37 panicle length, 2.7g test weight and 31.67 Q/ha grain yield, similarly cross 9 having 131 days to maturity, 9 tillers per plant, 24.27 cm panicle length, 2.67 g test weight and 32.67 q/ha grain yield and cross nine required 131 days to maturity, 8.47 tillers per plant, 24.17 cm panicle length, 3 g test weight and grain yield 31.47 q/ha.

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