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Correlation of Characters and Path Analysis among Different Traits of CMS Lines and Maintainers

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A B S T R A C T

Rice as a cereal grain is the most widely consumed staple food for a large part of world's human population, especially in Asia. Estimation correlation among different characters was undertaken by taking into consideration 8 CMS line and their maintainer lines. At genotypic level, grain yield per plant showed highly significant and positive correlation with date of panicle initiation, 50% panicle emergence, 100% panicle emergence, panicle per plant, no. of tillers and days of maturity and negatively correlated with pollen sterility. Path coefficient analysis revealed at phenotypic level number of tillers had highest positive direct effect towards grain yield per plant followed by days to maturity, 50% panicle emergence, main stem length, 100% panicle emergence, spikelet per plant, test weight, panicle length and stigma length.

Introduction

Rice is important cereal grain for about 60% of total world population. As it is consumed by a larger fraction of world and Indian population. Hybrid rice is the commercial rice crop grown from F1 seeds of a cross between two genetically dissimilar parents. Good rice hybrids have the potential of yielding 20-30% more than the conventional inbred varieties grown under similar conditions. Hybrid rice technology, commercialized first in China, has spread to about 54% of the rice area of that country, contributing 60% of its national paddy production. Presently cytoplasmic male sterility is being used for synthesizing hybrid varieties of rice. Crop improvement programmes depend to a large extent on availability of sufficient variability and association among different characters which are the pre-requisite for executing an effective selection programme.

Grain yield is a complex traits expressed as cumulative effect of various component traits. A few of the component traits may be directly or positively associated with grain yield and often proved to be useful indicator while selection of yield improvement. Therefore, knowledge of association of different

components together with their relative contributions has immense value in selection.

Materials and Methods

The experiment was being carried out in 1st Year at the BSPC during *kharif* 2014, GBPUA&T and in 2nd year at the N.E. Borlaug, Crop Research Centre (CRC) of G. B. Pant University of Agriculture and Technology, Pantnagar during *kharif* 2015. The research centre lies in the tarai belt, 30 km southern end of foothills of Shivalik range of Himalayas at 29°N latitude and 79.29°E longitude and an altitude of 243.83 m above mean sea level. Climate and weather: Pantnagar represents both sub-humid, sub-tropical climate with hot and dry summer and severe cold winters, generally rainfall is 1420 mm. In both the year the experiment were evaluated in Randomised block design with 3 replication.

CMS lines and their respective marker are transplanted in pairs. The experimental material comprised of 8 CMS lines and their respective 8 maintainer lines. All the lines were previously developed. Staggered sowing is done in case of maintainer line to provide pollen to A line for longer duration. A line and B line are transplanted in alternate line in continuous manner so that maximum number of parent available for seed set.

Results and Discussion

Correlation analysis

Over the years, grain yield per plant had significant correlation with panicle initiation, days to 50% flowering, days to 100% flowering, days to maturity and number of tillers.

The observations recorded were in agreement with the results of Kumar *et al.,* (2007) and Singh *et al.,* (2013). Panicle per plant was also highly significant and positively correlated with grain yield per plant similar result also reported by Patil and Sarawgi (2005).

As per the study of Rajkumar *et al.,* (2015) on CMS line for morphological character variation in plant height, number of panicle per plant and panicle length found effecting rate of outcross.

In this experiment also in case of variation in plant height between A line and B line effects number of grain per plant negatively. So there was a negative correlation between the plant height and grain per plant in case of CMS line.

For better grain per plant the height of CMS line should be shorter than maintainer plant. Also character like panicle per plant and number of tillers per plant found highly significant and positively correlated with grain per plant.

Panicle length was also found highly significant and positively correlated with main stem length similar result also found in study conducted by of Rajkumar *et al.,* (2015) and Hasan *et al.,* (2011).

Pollen sterility had significant correlation with panicle initiation, 50% flowering, 100% flowering, maturity duration, plant height and grain yield per plant. It had negative correlation with flowering duration, maturity duration and grain yield per plant and these result are also in agreement with observation found by Pradhan and Ratho (1990).

Hence from the above result it was conclude that selecting genotype based on panicle initiation, days to 50% flowering, days to 100% flowering, panicle per plant, days to maturity and no. of tillers breeder can select CMS line and maintainer liner of higher grain per plant (Tabl 1 and 2).

Table.1 Genotypic correlation coefficient among quantitative traits during of combined year/ pooled data of CMS and Maintainer lines

	PI	50%F	100%F	PS	FLL	FLW	NT	SL	MSL/CL	PPP	SPL	DM	PL	TW	GPP
PI	**1.000**														
50%F	0.940**	**1.000**													
100%F	0.994**	0.980**	**1.000**												
PS	-0.828**	-0.827**	-0.729**	**1.000**											
FLL	0.253	-0.016	0.018	-0.240	**1.000**										
FLW	0.231	0.481**	0.415*	-0.135	-0.308	**1.000**									
NT	0.329	0.308	0.272	-0.313	0.235	0.270	**1.000**								
SL	0.302	0.125	0.211	-0.099	0.134	0.034	0.167	**1.000**							
MSL	-0.102	-0.719**	-0.078	0.651**	0.538**	-0.540**	0.316	0.249	**1.000**						
PPP	0.363*	0.187	0.259	-0.302	0.420*	0.158	1.324**	0.243	0.384*	**1.000**					
SPL	0.022	-0.115	-0.396*	-0.270	0.442*	-0.569**	-0.240	-0.489**	-0.881**	-0.880**	**1.000**				
DM	0.937**	0.987**	0.803**	-0.945**	-0.082	0.176	-0.029	0.175	-1.496**	-0.282	-0.043	**1.000**			
PL	-0.102	-0.166	-0.095	0.127	0.489**	-0.047	0.653**	0.127	0.918**	0.891**	-0.458**	-0.386*	**1.000**		
TW	0.387*	0.503**	0.439*	-0.154	0.367*	0.352*	0.220	-0.273	-0.467**	0.068	0.411*	0.382*	0.006	**1.000**	
GPP	0.811**	0.739**	0.639**	-0.981**	0.257	0.107	0.463**	0.150	-0.746**	0.602**	0.289	0.912**	0.021	0.134	**1.000**

Table.2 Genotypic path coefficient among quantitative traits combined over year/pooled data of CMS ad Maintainer lines

	PI	50%PE	100%PE	PS	FLL	FLW	NT	SL	MSL/CL	PPP	SPL	DM	PL	TW	Correlated with GPP
PI	**-0.15638**	-0.34854	0.12417	0.65288	-0.01842	-0.02592	0.23508	0.01993	-0.01839	-0.16926	0.00076	0.40055	-0.00573	0.04823	**0.811****
50%PE	-0.15168	**0.35933**	0.14286	0.62051	0.00097	-0.04788	0.19028	0.01837	-0.09067	-0.11990	-0.00187	0.42558	-0.00848	0.06369	**0.739****
100%PE	-0.07025	-0.18574	**0.27639**	0.32020	0.03227	-0.03249	-0.07883	0.03127	-0.13059	0.03313	-0.05274	0.28521	-0.01773	-0.04812	**0.639****
PS	0.12224	0.26698	-0.10597	**-0.83516**	0.02061	0.01653	-0.23851	-0.01456	0.11766	0.11468	-0.02653	-0.40248	0.00909	-0.02268	**-0.981****
FLL	-0.03314	0.00401	-0.10261	0.19798	**-0.08693**	0.03316	0.16004	0.00593	0.11850	-0.14233	0.05077	-0.02006	0.03406	0.05104	**0.257**
FLW	-0.03586	-0.15223	0.07945	0.12214	0.02550	**-0.11303**	0.21372	0.00010	-0.09793	-0.06537	-0.03697	0.11549	-0.00935	0.04422	**0.107**
NT	-0.04624	-0.08600	-0.02741	0.25055	-0.01750	-0.03038	**0.79501**	0.00102	0.06876	-0.52928	-0.01457	0.01107	0.04305	0.01923	**0.463****
SL	-0.04568	-0.09674	0.12667	0.17819	-0.00755	-0.00016	0.01191	**0.06823**	-0.07276	-0.02192	-0.01977	0.15191	0.01392	-0.00767	**0.150**
MSL	0.00965	0.10932	-0.12111	-0.32972	-0.03457	0.03714	0.18341	-0.01666	**0.29802**	-0.20076	-0.02769	-0.32996	0.04562	-0.03267	**-0.746****
PPP	-0.04819	-0.07844	-0.01667	0.17439	-0.02253	-0.01345	0.76616	0.00272	0.10894	**-0.54921**	-0.02785	-0.04065	0.04504	-0.00553	**0.602****
SPL	-0.00090	0.00514	-0.11123	0.16906	-0.03368	0.03189	-0.08842	-0.01030	-0.06296	0.11673	**0.13104**	0.07021	0.02499	0.04256	**0.289**
DM	-0.12829	-0.31322	0.16146	0.68849	0.00357	-0.02674	0.01803	0.02123	-0.20141	0.04572	0.01884	**0.48823**	0.03188	0.03906	**0.912****
PL	0.01100	0.03743	-0.06016	-0.09322	-0.03635	0.01298	0.42021	0.01166	0.16694	-0.30371	-0.04022	-0.19113	**0.08144**	0.00393	**0.021**
TW	-0.05390	-0.16358	-0.09506	0.13540	-0.03171	-0.03572	0.10926	-0.00374	-0.06960	0.02171	0.03986	0.13630	0.00229	**0.13991**	**0.134**

Path coefficient analysis

The path coefficient analysis over the years carried out at genotypic level showed positive effect of spikelet 50% panicle emergence, spikelet per panicle, number of tillers per plant, panicle length and stigma length showed positive effect on grain yield per plant.

The result obtained from this analysis is more or less in conformity with the findings from such analysis. Bornare *et al.,* (2014) observed positive direct effect of spikelet density, effective tillers/plant, panicle length, duration of floret opening, 1,000 seed weight and date of 50% flowering on grain yield per plant. Mohammad *et al.,* (2013) reported that days to 50% flowering, 1000-grain weight, number of spikelets per panicle and panicle length has high direct effects on grain yield per plant. Khedikar *et al.,* (2004) observed test weight had the highest positive direct effect on grain yield per plant followed by spikelet density, effective tillers per plant, panicle length and days to 50% flowering. Borbora *et al.,* (2005) reported highest positive direct effect of grain yield per plant followed on secondary branches per panicle and plant height. Filled grains per panicle, primary branches per panicle and 1000-grain weight showed highest indirect effect on yield per plant. Zia-ul-Qamar *et al.,* (2005) reported that reproductive tillers per plant, days to maturity and days to 50% flowering had positive and direct contribution to grain yield per plant in rice.

In the present study 50% panicle emergence, spikelet per panicle, number of tillers per plant, panicle length and stigma length identified as most important characters for direct as well as indirect contributor to grain per plant. Hence selection for these traits would be effective in increasing grain per plant in CMS lines and its maintainers

In conclusion, at genotypic level, grain yield per plant showed highly significant and positive correlation with date of panicle initiation, 50% panicle emergence, 100% panicle emergence, panicle per plant, no. of tillers and days of maturity and negatively correlated with pollen sterility. Pollen sterility significantly negatively correlated with 50% panicle emergence, 100% panicle emergence and days of maturity. Panicle per plant was highly significantly & positively correlated with no. of tillers and panicle length.

Path coefficient analysis revealed at phenotypic level number of tillers had highest positive direct effect towards grain yield per plant followed by days to maturity, 50% panicle emergence, main stem length, 100% panicle emergence, spikelet per plant, test weight, panicle length and stigma length.

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