



## Correlation and Path Coefficient Analyses in CMS Lines for Floral and Morphological Traits in Rice (*Oryza sativa* L.)

V Bush, P V Satyanarayana, Lal Ahamed M and V Satyanarayana Rao

Department of Genetics and Plant Breeding, Agricultural College, Bapatla 522101, Andhra Pradesh

### ABSTRACT

Correlation and path coefficient analyses were done using floral and morphological traits in 15 cytoplasmic male sterile lines of rice. Correlation studies revealed that outcrossing percentage had positive and significant association with panicle exertion percentage, angle of floret opening, flag leaf angle, duration of floret opening, stigma length, anther length and stigma exertion percentage. While, path analysis indicated that panicle exertion percentage, angle of floret opening, flag leaf angle, floret opening duration, stigma length, anther length and stigma exertion per cent had positive direct effect on outcrossing percentage.

**Key words :** Correlation, CMS lines, Hybrid Rice, Path Coefficient.

Rice (*Oryza sativa* L.) is grown in varied climatic conditions as different farming systems and is a major cereal for half of the world population. To meet the ever increasing population, attempts were made to produce hybrids in rice. The success of hybrid rice breeding depends on the extent of natural outcrossing in CMS lines, which in turn depends on number of floral and morphological traits. Keeping this in view an attempt has been made to assess the correlation and direct effects of various floral and morphological traits in CMS lines on outcrossing per cent.

### MATERIAL AND METHODS

The present investigation was carried out during *rabi* 2008-09 at Andhra Pradesh Rice Research Institute and Regional Agricultural Research Station (APRRI and RARS) Maruteru, Andhra Pradesh, with 15 CMS lines of rice by planting 2 rows of CMS line flanked by two rows of maintainer line either side.

Observations were recorded on ten randomly selected plants and on plot basis from each replication for characters *viz.*, panicle exertion percentage, flag leaf angle, flag leaf length, flag leaf width, anther length, stigma length, stigma exertion percentage, angle of floret opening, duration of floret opening, number of spikelets per panicle and out crossing percentage. Correlation coefficients as per Falconer (1964) and path effects as per Dewy and Lu (1921) were calculated.

### RESULTS AND DISCUSSION

Genotypic correlation coefficients were higher than phenotypic correlation coefficients for most of the characters indicating there was strong

inherent association between characters, which was truly reflected in phenotypic expression (Table 1).

Character association studies revealed positive and significant association of outcrossing percentage with panicle exertion percentage (0.5280\*\* and 0.4439\*\*), angle of floret opening (0.9322\*\* and 0.3041\*), flag leaf angle (0.6763\*\* and 0.5369\*\*), duration of floret opening (0.6497\*\* and 0.5563\*\*), stigma length (0.5369\*\* and 0.3916\*\*), anther length (0.5501\*\* and 0.3739\*\*) and stigma exertion percentage (0.6051\*\* and 0.4666\*\*) both at phenotypic and genotypic levels, respectively. The present results are in conformity with the studies of Sadawarti *et al.* (2007), Ingale *et al.* (2004), Banumathy *et al.* (2002), Long Lihua and Shu Kun (2000) and Ramalingam *et al.* (1999).

Phenotypic path analysis revealed that panicle exertion percentage (0.0189), floret opening duration (0.4583), stigma length (0.2398) and stigma exertion percentage (0.1223) had positive direct effects on outcrossing percentage (Table 2). These results clearly indicated the importance of these traits in improving the outcrossing potential of these CMS lines.

In plant breeding, it is very difficult to have complete knowledge of all component traits that affect the out crossing percentage. The residual effect permits precise explanation about the pattern of interaction of other possible components on outcrossing percentage. In other words, residual effect measures the role of the possible independent variables which were not included in the study on the dependent variable. In the present study, the residual effect observed was high (0.5725), so the characters included in the present study were not able to explain the direct and indirect effects on the dependent variable.

Table 1. Phenotypic (above diagonal) and genotypic (below diagonal) correlations for floral and morphological characters in CMS lines of rice (*Oryza sativa* L.)

Character	No of spikelets panicle <sup>-1</sup>	Panicle exertion %	Angle of floret opening	Flag leaf angle	Floret opening duration	Flag leaf length	Flag leaf width	Stigma length	Anther length	Stigma exertion %	Out crossing %
No of spikelets panicle <sup>-1</sup>	-	0.3080*	-0.0470	-0.1253	-0.2780	0.2747	0.5308**	-0.2760	-0.4095**	-0.3045*	-0.2146
Panicle exertion %	0.4281**	-	0.1425	0.2605	0.0106	-0.1248	0.4233**	0.0303	-0.0603	0.2702	0.4439**
Angle of floret opening	-0.2008	0.2580	-	0.2907	0.4284**	-0.4155**	0.1260	0.2016	0.2413	0.3896**	0.3041*
Flag leaf angle	-0.1965	0.2992*	0.6951**	-	0.7536**	-0.3101*	0.0840	0.4511**	0.6268**	0.5406**	0.5369**
Floret opening duration	-0.2964*	0.0203	0.7804**	0.8190**	-	-0.5043**	0.0850	0.2408	0.5202**	0.4327**	0.5563**
Flag leaf length	0.2899	-0.1774	-0.8209**	-0.4036**	-0.5338**	-	-0.1725	-0.0619	-0.2090	-0.0771	0.5363**
Flag leaf width	0.7406**	0.6504**	0.1374	0.0526	0.1115	-0.1329	-	-0.3963**	-0.3994**	-0.2205	0.0147
Stigma length	-0.3039*	0.1144	0.5541**	0.6566**	0.3290*	-0.1964	-0.5207**	-	0.4598**	0.4478**	0.3916**
Anther length	-0.6870**	-0.1407	0.7318**	0.8474**	0.7494**	-0.3413*	-0.5808**	0.8204**	-	0.5323**	0.3739*
Stigma exertion %	-0.4396**	0.3307*	0.6666**	0.6220**	0.4601**	-0.0839	-0.2039	0.5595**	0.8378**	-	0.4666**
Out crossing %	-0.1602	0.5280**	0.9322**	0.6763**	0.6497**	-0.6411**	0.0708	0.5369**	0.5501**	0.6051**	-

\* = Significant at 5% level, \*\* = Significant at 1% level

Table 2. Direct and indirect effects of floral and morphological characters on out crossing percentage in 15 CMS lines of rice (*Oryza sativa* L.)

Character	No of spikelets panicle <sup>-1</sup>	Panicle exertion %	Angle of floret opening	Flag leaf angle	Floret opening duration	Floret length	Flag leaf width	Stigma length	Anther length	Stigma exertion %
No of spikelets panicle <sup>-1</sup>	<b>0.0189</b>	0.0058	-0.0009	-0.0024	-0.0052	0.0052	0.0100	-0.0052	-0.0077	-0.0057
Panicle exertion %	0.1448	<b>0.4702</b>	0.0670	0.1225	0.0050	-0.0587	0.1990	0.0142	-0.0283	0.1271
Angle of floret opening	0.0065	-0.0197	<b>-0.1386</b>	-0.0403	-0.0594	0.0576	-0.0175	-0.0279	-0.0334	-0.0540
Flag leaf Angle	0.0202	-0.0420	-0.0468	<b>-0.1612</b>	-0.1214	0.0500	-0.0135	-0.0727	-0.1010	-0.0871
Floret opening duration	-0.1274	0.0049	0.1963	0.3454	<b>0.4583</b>	-0.2311	0.0390	0.1104	0.2384	0.1983
Flag leaf length	-0.0989	0.0449	0.1496	0.1116	0.1815	<b>-0.3600</b>	0.0621	0.0223	0.0752	0.0278
Flag leaf width	-0.0760	-0.0606	-0.0180	-0.0120	-0.0122	0.0247	<b>-0.1432</b>	0.0567	0.0572	0.0316
Stigma length	-0.0662	0.0073	0.0484	0.1082	0.0577	-0.0149	-0.0950	<b>0.2398</b>	0.1103	0.1074
Anther length	0.0007	0.0001	-0.0004	-0.0011	-0.0009	0.0004	0.0007	-0.0008	<b>0.0018</b>	-0.0010
Stigma exertion %	-0.0372	0.0330	0.0476	0.0661	0.0529	-0.0094	-0.0270	0.0548	0.0651	<b>0.1223</b>
<b>Correlation with out-crossing %</b>	<b>-0.2146</b>	<b>0.4439**</b>	<b>0.3041*</b>	<b>0.5369**</b>	<b>0.5563**</b>	<b>-0.5363**</b>	<b>0.0147</b>	<b>0.3916**</b>	<b>0.3739*</b>	<b>0.4666**</b>

Bold diagonal values indicate direct effects; Residual effect = 0.5725

Hence it can be concluded that selection based on panicle exertion percentage, floret opening duration, stigma length and stigma exertion percentage may help in improving outcrossing percentage in CMS lines, which in turn enhances the hybrid seed quantity and thus making hybrid seed production more economical, viable and profitable to the seed industry and ultimately to the farming community at large.

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