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Correlation and path co-efficient analysis in pearl millet [*Pennisetum glaucum* (L.)]

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SUMMARY

A set of 64 genotypes comprising of 48 F_1s along with fertile counter parts of four male sterile lines and 12 pollinators were evaluated in randomized block design with three replications to study the correlation and path co-efficient analysis for ten quantitative characters in pearl millet at Pearl millet Research Station, Junagadh Agricultural University, Jamnagar during *Kharif* season of 2009-10. Correlation studies revealed that the characters *viz*., ear head weight, number of nodes per plant and plant height exhibited significant positive correlation with grain yield indicated major role of these traits in contribution of grain yield. Path co-efficient analysis showed that number of nodes per plant, ear head length, ear head weight and ear head girth were the most important characters manifesting large direct effects on grain yield. The high association of ear head weight and number of nodes per plant with grain yield and their inter-associations and also their large direct effect on grain yield suggest that ear head weight and number of nodes per plant merit maximum emphasis in selection for improvement of grain yield in pearl millet.

Key words : Correlation co-efficient, Path analysis, Pearl millet

Pearl millet [*Pennisetum glaucum* (L.)] is the fourth most food grain crop after rice, wheat and sorghum in India, and grown mainly in Rajasthan, U. P., Maharashtra, Gujarat and Haryana which account for 95 % of the area under this crop. Yield being a complex character is dependent on a number of characters. Knowledge of interrelationship between yield and its components and the relative weightage which should be given to different yield components to obtain maximum gain is most important. Though correlation studies are helpful in measuring the association between yield and component characters, they do not provide an exact picture of the direct and indirect causes of such an association which can be had through path coefficient analysis (Wright, 1923). Therefore, in the present investigation, correlation and path co-efficient analysis were carried out for ten quantitative characters of pearl millet during *Kharif* season of 2009-10.

MATERIALS AND METHODS

In the present investigation, four male sterile lines (ICMA-95444, ICMA-98444, JMSA-20072, JMSA-20073) and 12 diverse restorer lines (J-2290, J-2340, J-2405, J-2433, J-2454, J-2467, J-2474, J-2479, J-2483, J-2495, J-2498, H-77/833-2) were crossed in a line x tester mating design during summer-2009. The resultant 48 hybrids along with fertile counter part of four male sterile lines and 12 male parents were evaluated in randomized block design with three replications at Pearl millet Research Station, Junagadh Agricultural University, Jamnagar, Gujarat, during *Kharif* season of 2009-10. Each entry was grown in a single row of 5.0 m length each with inter and intra row spacing of 60 x 15 cm. The recommended agronomic practices and plant protection measures whenever necessary were adopted for raising the good crop. Observations were recorded on ten randomly selected competitive plants for each entry, in each replication for ten characters (Table 1). Mean values were subjected to standard statistical procedures namely, phenotypic and genotypic correlations (Falconer, 1964) and path co-efficient analysis (Dewey and Lu, 1959).

RESULTS AND DISCUSSION

The estimates of phenotypic and genotypic correlations of various components with grain yield and their direct and indirect effects contributing towards yield are presented in Table 1. The genotypic correlation co-efficients, in general, were higher in magnitude than their corresponding phenotypic estimates showing the efficiency of genotypic estimates over phenotypic ones. The higher magnitude of genotypic correlations observed in the present study was supported by Balakrishnan and

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Table 1 : Phenotypic (below diagonal), genotypic (above diagonal) correlation and path co-efficient of quantitative traits in pearl millet

Characters	Grain yield / plant (g)	Days to 50 % flowering	No. of nodes /plant	Plant height (cm)	Ear head girth (cm)	Days to maturity	1000-grain weight (g)	Fodder yield /plant (g)	Ear head length (cm)	Ear head weight (g)
Grain yield / plant (g)	1.000	-0.295*	0.373**	0.369**	0.018	-0.223	0.091	0.198	0.208	0.930**
Days to 50	-0.241	1.000	-0.241	-0.318*	-0.102	0.911**	-0.247*	0.130	-0.249*	-0.236
% flowering		**(0.036)**	(9.073)	(-1.629)	(4.152)	(2.831)	(-2.230)	(3.256)	(4.386)	(3.526)
No. of nodes	0.236	-0.119	1.000	0.630**	0.087	-0.011	0.114	0.118	0.243	0.258*
/plant		(1.126)	**(0.287)**	(-1.101)	(3.897)	(3.704)	(-2.268)	(4.076)	(7.414)	(5.365)
Plant height	0.250*	-0.160	0.236	1.000	0.098	-0.174	0.319*	0.471**	0.669**	0.405**
(cm)		(1.265)	(6.890)	**(-0.046)**	(1.736)	(1.736)	(-1.187)	(3.203)	(5.891)	(4.111)
Ear head	0.030	-0.114	0.085	0.024	1.000	-0.066	0.245	-0.092	0.236	0.077
girth (cm)		(1.219)	(9.216)	(-0.656)	**(0.121)**	(2.157)	(-1.671)	(1.969)	(5.120)	(4.125)
Days to	-0.180	0.919**	0.014	-0.105	-0.112	1.000	-0.214	0.145	-0.111	-0.213
maturity		(0.959)	(10.106)	(-0.757)	(2.489)	**(0.105)**	(-2.064)	(2.458)	(4.643)	(3.261)
1000-grain	0.078	-0.172	0.091	0.128	0.150	-0.137	1.000	0.023	0.242	0.104
weight (g)		(1.051)	(8.613)	(-0.720)	(2.683)	(2.873)	**(-0.076)**	(2.331)	(4.202)	(2.843)
Fodder yield	0.190	0.097	0.090	0.303*	-0.074	0.100	0.021	1.000	0.232	0.183
/plant (g)		(1.090)	(10.996)	(-1.381)	(2.246)	(2.431)	(-1.656)	**(0.106)**	(3.799)	(2.968)
Ear head	0.198	-0.206	0.142	0.384**	0.195	-0.091	0.160	0.209	1.000	0.162
length (cm)		(0.852)	(11.599)	(-1.473)	(3.387)	(2.662)	(-1.731)	(2.203)	**(0.184)**	(2.717)
Ear head	0.907**	-0.201	0.170	0.256*	0.066	-0.178	0.073	0.181	0.149	1.000
weight (g)		(0.902)	(11.054)	(-1.354)	(3.594)	(2.462)	(-1.542)	(2.267)	(3.578)	**(0.139)**

* and ** indicate significance of values at P=0.05 and 0.01,, respectively.

Figures in parentheses denote path co-efficient values; Underlined bold figures indicate direct effects; Residual effects = 2.1402

Das (1995), Poongodi and Palanisamy (1995), Singh (1996), Borkhataria *et al*. (2005) and Chandolia and Prem Sagar (2005). The perusal of correlation estimates (Table 1) revealed that grain yield per plant had significant positive correlation with number of nodes per plant, plant height and ear head weight at both genotypic and phenotypic levels except number of nodes per plant where it was not significantly correlated with grain yield at phenotypic level, indicating that these attributes were more influencing the grain yield in pearl millet. The days to 50 % flowering manifested negatively significant correlation with grain yield at genotypic level only. The remaining characters showed non-significant and positive relationship with grain yield except days to maturity where it was negatively non-significant correlated with grain yield. Strong positive correlation of grain yield with ear head weight and plant height has also been reported by Kunjir and Patil (1986), Sagar (1992), Singh (1996) and Chandolia and Prem Sagar (2005).

Considering the interrelationship among the yield components, days to 50 % flowering had significant positive genotypic as well as phenotypic correlations with days to maturity; whereas, days to 50 % flowering was negatively significant genotypic associated with plant height, 1000-grain weight and ear head length. While, plant height was significant positive genotypic and phenotypic correlated with ear head length, ear head weight and dry fodder yield per plant; but it was positive significant interrelated with number of nodes per plant and 1000-grain weight at genotypic level. The character like number of nodes per plant showed positive and significant genotypic correlation with ear head weight. Thus, the results suggested that the characters like ear head weight, plant height and number of nodes per plant were not only directly contributing towards grain yield but they all were also closely inter-related. Therefore, selection based on any of these yield components is likely to bring improvement in yield. The remaining component characters showed either positively or negatively non-significant relationship with each others. These findings are in accordance with the results of Kunjir and Patil, (1986), Sagar (1992), Balakrishnan and Das (1995), Singh

(1996), Borkhataria *et al*. (2005) and Chandolia and Prem Sagar (2005).

Positive correlation of a particular trait with yield does not necessarily mean a direct, positive effect of that trait on yield. Therefore, path co-efficient analysis which analyses cause and effect relationship and partitions the correlation into direct and indirect effects was carried out. In the present investigation, number of nodes per plant (0.287) had shown the highest positive direct contribution to grain yield followed by ear head length (0.184), ear head weight (0.139) and ear head girth (0.121). In the present study, significant and high positive correlations of ear head weight and number of nodes per plant with grain yield were due to their substantially large positive direct effects on grain yield. The characters *viz*., dry fodder yield per plant (0.106), days to maturity (0.105) and days to 50 % flowering (0.036) had positive low direct effects on grain yield. Whereas, plant height (-0.046) and 1000-grain weight (-0.076) depicted negatively low direct effects on grain yield. Karthigeyan *et al.* (1995) reported positive direct effects of ear head weight, ear head length and ear head girth on grain yield. Similarly, Chandolia and Prem sagar (2005) also found positive direct effects of ear head weight, ear head length, ear head girth, fodder yield per plant and days to maturity on grain yield. There were not only the important direct sharing characters but also were important indirect contributions through the characters among them. The indirect effects of number of nodes per plant via all other characters were positive except for plant height and 1000-grain weight, which were negative. Similarly, the indirect effects of ear head weight via days to 50 % flowering, number of nodes per plant, ear head girth, days to maturity, fodder yield per plant and ear head length were positive and higher in magnitude. Though plant height had shown significant and positive correlation with grain yield (Table 1), the direct effect of this trait to grain yield was negative (-0.046). The high correlation observed by this trait with grain yield was mainly due to its indirect contribution through number of nodes per plant, ear head length, ear head weight, fodder yield per plant, ear head girth and days to maturity.

From the present study of path analysis together with results of correlation, it is shown that ear head weight and number of nodes per plant had significant positive correlation and high positive direct effects on grain yield. These component traits also exhibited positive inter-associations with other characters and higher positive indirect effects on grain yield in irrespective of management practices. Hence, these components may be given due importance in selection programme to improve the grain yield in pearl millet.

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