RESEARCH PAPER

# Character association and path analysis in pearl millet [*Pennisetum glaucum* (L.) R. Br.]

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A set of 60 genotypes comprising of 45 $F_1$s along with fertile counter parts of five male sterile lines, nine testers and one standard check hybrid (GHB-744) were utilized to study the correlation and path analysis for nine quantitative characters in pearl millet during *Kharif* season of 2011-2012. Correlation studies revealed that the characters *viz*., ear head weight, number of nodes per plant, fodder yield per plant and harvest index exhibited significant positive correlation with grain yield indicated major role of these traits in contribution of grain yield. Path co-efficient analysis showed that ear head length, harvest index, number of nodes per plant and fodder yield per plant were the most important characters manifesting large positive direct effects on grain yield. The high association of fodder yield per plant, harvest index and number of nodes per plant with grain yield and their inter-associations and also their large direct effect on grain yield suggest that these traits merit maximum emphasis in selection for improvement of grain yield in pearl millet.

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

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## INTRODUCTION

Yield is the most economic character in almost all of the crops. Yield is a complex entity and inheritance of yield depends upon a number of characters which are often polygenic in nature and are highly affected by environmental factors (Nadarajan and Gunasekaran, 2005). Knowledge of genetic system controlling yield and its components is useful in understanding the prepotency of the parents and thus help to select parents possessing in-built genetic potential. For efficient selection, programme interrelationship between yield and its components is inevitable and mutual association of plant characters, which is determined by correlation coefficient and is used to find out the degree (strength), mutual relationship between various plant characters and the component character on which selection can be relied upon the genetic improvement of yield. But information on the relative importance of direct and indirect effects of each component characters towards yield is not provided by such studies. Path coefficient analysis is helpful in partitioning the correlation into direct and indirect effects so that relative contribution of each component character to the yield could be assessed (Singh and Narayanam, 2007). Therefore, the present investigation was undertaken to determine the mutual association among nine selected traits in pearl millet and their direct and indirect effects on yield by using path coefficient analysis.



## RESEARCH METHODOLOGY

In the present investigation, five male sterile lines (ICMA-98444, JMSA-20081, JMSA-20091, ICMA-65550, ICMA-841) and nine diverse restorer lines (J-2340, J-2405, J-2433, J-2480, J-2482, J-2495, J-2496, J-2507, J-2526) were crossed in a line x tester mating design during summer-2011. The resultant 45 hybrids along with fertile counter part of five male sterile lines, nine pollinators and one standard check hybrid (GHB-744) were evaluated in randomized block design with three replications at Pearl millet Research Station, Junagadh Agricultural University, Jamnagar, Gujarat, during *Kharif* season of 2011-2012. Each entry was grown in a single row of 5.0 m length each with inter and intra row spacing of 60 cm x 15 cm. The recommended agronomic practices and plant

protection measures whenever necessary were adopted for raising the good crop. Observations were recorded on five randomly selected competitive plants for each entry, in each replication for nine characters (Table 1). Phenotypic and genotypic correlation coefficients were computed utilizing the procedure described by Falconer (1964). The significance of correlation coefficient was tested by referring to the standard table given by Snedecor (1961). The path analysis was carried out as per the procedure suggested by Dewey and Lu (1959).

## RESEARCH FINDINGS AND ANALYSIS

The nature and the extent of association that existed between grain yield and its components and the association between the yield component characters were studied. 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-efficient, in general, were higher in magnitude than their corresponding phenotypic estimates showing the efficiency of genotypic estimates over phenotypic ones. These results are in accordance with the findings of Singh (1996), Borkhataria *et al.* (2005) and Chandolia and Prem Sagar (2005). The perusal of correlation estimates (Table 1) revealed that number of nodes per plant, ear head weight, fodder yield per plant and harvest index had significant and positive genotypic as well as phenotypic correlations with grain yield. This confirmed that these four attributes were more influencing the grain yield in pearl millet. The remaining characters under study showed either positive or negative non-significant relationship with grain yield. This is in conformity with the results of Sagar (1992), Singh (1996), Manojkumar *et al.* (2002) and Chandolia and Prem Sagar (2005).

Considering the interrelationship among the yield components, number of nodes per plant had significant positive genotypic as well as phenotypic correlations with threshing index; while, ear head girth, ear head length, fodder yield per plant and harvest index showed significant positive association with number of nodes per plant at genotypic level only. Ear head girth was significant positive genotypic correlated with ear head length; but it was significant negatively interrelated with threshing index at genotypic level. The characters like ear head length and threshing index showed significant and positive genotypic as well as phenotypic correlations with fodder yield per plant. Harvest index had highly significant and positive correlation with ear head weight and threshing index. Thus, the results suggested that the characters like number of nodes per plant, ear head weight, fodder yield per plant and harvest index 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

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

| Characters | Grain yield / plant (g) | No. of nodes/ plant | No. of effective tillers/plant | Ear head girth (cm) | Ear head length (cm) | Ear head weight (g) | Fodder yield /plant (g) | Harvest index (%) | Threshing index (%) |
|---|---|---|---|---|---|---|---|---|---|
| Grain yield / plant (g) | 1.000 | 0.364** | -0.035 | -0.005 | 0.201 | 0.813** | 0.385** | 0.701** | 0.201 |
| No. of nodes/ plant | 0.258* | 1.000 (**0.183**) | -0.058 (3.717) | 0.331** (-8.893) | 0.404** (19.647) | 0.123 (0.233) | 0.291* (4.380) | 0.335** (11.893) | 0.411** (7.741) |
| No. of effective tillers / plant | -0.031 | -0.019 (3.220) | 1.000 (**0.095**) | -0.022 (-9.046) | -0.147 (19.957) | -0.002 (0.237) | -0.038 (3.947) | -0.050 (10.806) | -0.054 (7.084) |
| Ear head girth (cm) | -0.017 | 0.149 (2.890) | -0.019 (3.393) | 1.000 (-**0.254**) | 0.395** (13.288) | 0.113 (0.163) | -0.074 (3.814) | -0.023 (9.508) | -0.283* (6.298) |
| Ear head length (cm) | 0.142 | 0.250 (3.137) | -0.104 (3.678) | 0.188 (-6.530) | 1.000 (**0.517**) | 0.147 (0.214) | 0.342** (5.668) | 0.004 (15.122) | 0.061 (9.694) |
| Ear head weight (g) | 0.675** | 0.036 (3.385) | -0.016 (3.964) | 0.091 (-7.292) | 0.143 (19.389) | 1.000 (**0.006**) | 0.164 (3.610) | 0.400** (7.787) | -0.398** (3.651) |
| Fodder yield /plant (g) | 0.367** | 0.183 (3.005) | -0.048 (3.126) | -0.066 (-8.054) | 0.272* (24.352) | 0.118 (0.171) | 1.000 (**0.120**) | -0.225 (9.961) | 0.327* (4.820) |
| Harvest index (%) | 0.715** | 0.248 (3.253) | -0.009 (3.412) | -0.029 (-8.004) | -0.043 (25.903) | 0.197 (0.147) | -0.186 (3.971) | 1.000 (**0.302**) | 0.415** (4.016) |
| Threshing index (%) | 0.181 | 0.288* (3.501) | -0.015 (3.698) | -0.159 (-8.766) | -0.026 (27.454) | -0.404** (0.114) | 0.299* (3.177) | 0.630** (6.641) | 1.000 (**0.083**) |

* 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 = 3.7668

yield. The remaining component characters showed either positive or negative non-significant relationship with each others. These findings are in accordance with the results of Sagar (1992), Singh (1996), Borkhataria *et al*. (2005), Chandolia and Prem Sagar (2005) and Arulselvi *et al*. (2008).

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, ear head length (0.517) had shown the highest positive direct contribution to grain yield followed by harvest index (0.302), number of nodes per plant (0.183) and fodder yield per plant (0.120). In the present study, significant and high positive correlations of harvest index, fodder yield per plant and number of nodes per plant with grain yield were due to their substantially large positive direct effects on grain yield. The characters *viz*., number of effective tillers per plant (0.095), threshing index (0.083) and ear head weight (0.006) had positive low direct effects on grain yield. Whereas, ear head girth (-0.254) depicted negatively high direct effects on grain yield. Karthigeyan *et al.* (1995) was reported positive direct effects of ear head weight and ear head length on grain yield. Similarly, Chandolia and Prem sagar (2005) also found positive direct effects of ear head weight, ear head length and fodder yield per plant on grain yield. Arulsevi *et al*. (2008) was manifested positive direct effects of number of effective tillers per plant and ear head length 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 all the traits were found to be positive towards the grain yield except ear head girth, which was negative. Ear head length had the highest positive indirect effect on grain yield through most of the traits under studied. In the present study, though ear head weight (0.813) had shown significant high positive correlations with grain yield, the direct effect of this trait to grain yield was low (0.006). The high correlation observed by ear head weight (0.813) with grain yield was mainly due to its positive indirect contribution through most of the traits studied.

From the present study of path analysis together with results of correlation, it is shown that fodder yield per plant, harvest index 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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