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Research Note

Correlation and path analysis in rainy season sorghum [*Sorghum bicolour* (L.) Moench]

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Abstract
Association and path analysis was attempted for five traits *viz*., days to 50% flowering, plant height, panicle length, days to maturity, test weight and grain yield per plant. Thirty sorghum hybrids their respective parents and three checks were studied. Grain yield had expressed highly significant and positive correlation with plant height, panicle length, days to maturity and test weight at both genotypic and phenotypic levels. The characters that had positive direct effects on grain yield at both phenotypic and genotypic levels were test weight (0.543, 0.557), panicle length (0.352, 0.354) days to 50%flowering (0.169, 0.206) and days to maturity (0.113, 0.084). Plant height (-0.108,-0.0829) had direct effect in negative direction at both phenotypic level and genotypic level. The inter-relationship among these characters might be used in the breeding programme to exploit the yield potential and to develop high yielding improved varieties with ease and target oriented research.

Keywords
Hybrids, Correlation, Path coefficient, Sorghum

Sorghum (*Sorghum bicolor* (L.) Moench) is an important staple food for more than 300 million people and feed for cattle in Asia and Africa. It is the fourth most important cereal crop following rice, wheat and maize. It is known for its drought tolerance and is an indispensable crop of vast rainfed areas in semi-arid regions in India. It is also grown in nutrient deficient soils and possesses tolerance to pests and diseases. The correlation and path analysis in combination, can give a better insight, into cause and effect relationship between different pairs of characters.

The correlation measures the relationship existing between pairs of traits. But dependent traits are an interaction product of many mutually associated components. The path analysis takes into account the cause and effect relationship between the variables by partitioning the association into direct and indirect effects through other independent variables..The path analysis helps to resolve these correlations, further it throws more light on the way in which component traits contribute towards specifically identifying important component traits. Grain yield is the product of interaction of component traits. Apart from correlation studies, path coefficient analysis is important to obtain information about different ways in which the component characters influences the grain yield. In present study, 32 sorghum hybrids along with, their respective parents and three checks were studied. The experiment was laid out in medium deep black soil under rainfed condition at Sorghum Improvement Project, University of Agricultural Sciences, Dharwad during *kharif* 2011. The randomized block design was followed with three replications and each entry was sown in two rows of 3 m length with inter row spacing of 45 cm and intra row spacing of 15 cm. All the recommended practices were followed to raise good crop. From each entry of every replication, five randomly selected plants were tagged for recording observations on all the quantitative characters. Days to 50 per cent flowering and days to maturity were recorded at plot level. Mean of five plants for each entry for each character was calculated and used for statistical analysis. Estimation of variation components and phenotypic and genotypic correlations were calculated by using the formulae given by Burton (1952) and Johnson *et al.* (1955). The simple correlation coefficient was subjected to path analysis (Dewey and Lu, 1959).

Phenotypic and genotypic correlations were calculated for six characters to know the nature of association existing among them. The results are presented in Table 1.

Days to 50% flowering showed highly non-significant positive correlation with grain yield at both genotypic and phenotypic level (Bueno, 1990). Larger the period for flowering may give scope for higher photosynthesis time. The significant correlation of plant height with grain yield was recorded. Further selection for any one of these traits results in development of dual purpose sorghum varieties which meet the two important demands of farmer for grain yield and fodder.

Panicle length recorded the significant positive association with grain yield at genotypic and phenotypic level (Iyanar *et al*., 2001; Umakanth *et al.*, 2005; Patil *et al.*, 2009 and Mahajan *et al*., 2011). This panicle length trait for increased grain yield, by way of accommodating more number of grains per panicle. Once the panicle length increases the number of grains obtained from per panicle increases, so the grain yield automatically increases. Hence selection for long and semi compact panicle may be practiced for gaining higher grain yield in sorghum. Days to maturity showed high significant positive association with grain yield at both phenotypic and genotypic level. These results are similar to that of relation between flowering and grain yield. This positive correlation of flowering and days to maturity with grain yield is may be because crop absorbs more amount of nutrients from the soil for longer period. 1000 grain weight showed highly significant and positive correlation with grain yield at both genotypic and phenotypic levels (Umakanth *et al.*, 2005; Patil *et al.*, 2009; Mahajan *et al*., 2011 and Veerabadhiran and Kennedy, 2001)**.**

The path co-efficient analysis also measures the relative importance of causal factors involved. This is simply a standardized partial regression analysis, wherein total correlation value is subdivided into causal scheme. In the present study, the path co-efficient analysis was carried out at both phenotypic and genotypic level (Table 2). Days to 50% flowering had negative indirect influence on grain yield at both phenotypic and genotypic levels through panicle length (-0.020, -0.023), test weight (-0.033, -0.043). Days to 50% flowering had non-significant positive correlation with grain yield. It showed highly positive direct effect on grain yield at both phenotypic and genotypic level (Iyanar *et al*., 2001; Veerabadhiran and Kennedy, 2001 and Patil *et al.*, 2009). Positive direct effect of this trait on grain yield may be due to response of different genotypes to this trait. Further, there may be one optimum level for this association. Plant height showed negative indirect influence on grain yield at both phenotypic and genotypic levels through days to flowering (-0.043, -0.032) length (-0.070, -0.05) and days to maturity (-0.021, -0.016) and test weight (-0.016, -0.012). Panicle length had significant association with grain yield. The direct effect of panicle length on grain yield was positive at both phenotypic and genotypic level. Panicle length showed positive indirect influence on grain yield at both genotypic and phenotypic levels through days to flowering (0.034, 0.038), plant height (0.225, 0.354) and test weight (0.165, 0.177). Whereas, panicle length showed positive direct effect of on grain yield (Kukadia *et al.,* 1980; Iyanar *et al*., 2001 and Patel *et al*., 1979).The result suggests that due to its positive direct effect and significant association with grain yield, this trait may contribute for increased grain yield.

The indirect positive effect on grain yield was exhibited by days to maturity via panicle length (0.009, 0.011), 1000 grain weight (0.577, 0.543), plant height (0.172, 0.0219) and days to flowering (0.030, 0.038) at both genotypic and phenotypic levels. Test weight had highly significant association with grain yield. This character had positive indirect influence on grain yield at both genotypic and phenotypic levels via panicle length (0.289, 0.254), plant height (0.0895, 0.081) and days to maturity (0.240, 0.200). It is apparent that increase in weight of grain certainly increases the total grain yield (Iyanar *et al*., 2001 and Ezeaku and Mohammed, 2006).This indicates that selection can also be performed for this trait in order to increase with grain yield.

In the present study, genotypic correlations were higher than phenotypic correlation for yield contributing character *viz.*, plant height, days to 50% flowering, panicle length, days to maturity and test weight indicating less influence of environment. The results also indicated that the influence of the environment on these characters is very less as there is not much difference between phenotypic and genotypic correlations of these characters. Hence, due consideration should be given to these characters while planning a breeding strategy for increased grain yield.

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Table 1. Genotypic and phenotypic correlation coefficients for yield and yield contributing characters in sorghum

Characters		Days to 50 % Flowering	Plant height	Panicle length	Days to Maturity	Test weight	Grain yield
Days to 50 % Flowering	P	1.000	0.395**	-0.121	0.337*	-0.196	0.025
	G	1.000	0.406**	-0.115	0.363*	-0.212	0.029
Plant height	P		1.000	0.638**	0.193	0.1491	0.312*
	G		1.000	0.652**	0.203	0.154	0.313*
Panicle length	P			1.000	0.0979	0.469**	0.544**
	G			1.000	0.108	0.501**	0.558**
Days to maturity	P				1.000	0.369*	0.389*
	G				1.000	0.416**	0.416**
Test weight	P					1.000	0.704**
	G					1.000	0.730**

P= Phenotypic level G=genotypic level * Significant 5% ** Significant 1%

Table 2. Direct and indirect effects on grain yield at phenotypic level and genotypic level in sorghum

Characters		Days to 50 % flowering	Plant height	Panicle length	Days to maturity	Test weight	Grain yield
Days to 50 % flowering	P	0.169	0.067	-0.020	0.057	-0.033	0.025
	G	0.206	0.083	-0.023	0.075	-0.043	0.029
Plant height	P	-0.032	-0.082	-0.053	-0.016	-0.012	0.312
	G	-0.043	-0.108	-0.070	-0.021	-0.016	0.313
Panicle length	P	-0.042	0.225	0.352	0.034	0.165	0.544
	G	-0.041	0.231	0.354	0.038	0.177	0.558
Days to maturity	P	0.038	0.021	0.011	0.113	0.041	0.389
	G	0.030	0.017	0.009	0.084	0.035	0.416
Test weight	P	-0.106	0.081	0.254	0.200	0.543	0.704
	G	-0.122	0.089	0.289	0.240	0.577	0.730