International Journal of Agricultural Sciences
Volume **10** | Issue 2 | June, 2014 | 608-611
e ISSN-0976-5670 | Visit us | *www.researchjournal.co.in*

***RESEARCH PAPER***

# Study of correlation and path analysis in dual purpose sorghum [*Sorghum bicolor* (L.) Moench]

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**Abstract :** The present investigation was carried out to study the correlation and path analysis in dual purpose sorghum (*Sorghum bicolor* L.) with the set of thirty seven genotypes of sorghum grown in Randomized Block Design with four replications. The correlation analysis suggested that the magnitude of genotypic correlations was higher as compared to their corresponding phenotypic correlations indicating the inherent relationship among the characters studied. Path co-efficient analysis considering 15 characters as a causal variables showed that the number of leaves per plant had highest positive direct effect on grain yield per plant followed by panicle diameter, leaf length, protein per cent in grain and thousand grain weight. Grain yield per plant exhibited significant positive association with thousand grain weight, stem girth, leaf length, panicle length, panicle diameter, panicle weight and protein per cent in grain at both genotypic and phenotypic levels.

**Key Words :** Variability, Heritability, Correlation, Path co-efficient, Sorghum

**View Point Article :** Patil, C.N., Rathod, A.H., Vaghela, P.O., Yadav, S.R., Patade, S.S. and Shinde, A.S. (2014). Study of correlation and path analysis in dual purpose sorghum [*Sorghum bicolor* (L.) Moench]. *Internat. J. agric. Sci.*, **10** (2): 608-611.

**Article History : Received :** 13.11.2013**; Revised :** 07.04.2014**; Accepted :** 20.04.2014

## INTRODUCTION

Sorghum [*Sorghum bicolor* (L.) Moench] is an important world crop, used for food (as grain) and forage. It belongs to family Poaceae and genus Sorghum. Sorghum is one of the important crops of which fodder is utilized to animals providing milk and meat for nourishment of human being. Besides the traditional use of grain and fodder, several alternative products such as starch, syrup, jaggery, alcohol, sugar, wine, vinegar, silage, pulp in paper industry use, sweetener and natural pigments can be obtained. Use of ethanol extracted from sweet sorghum in automobiles holds a great promise for reducing air pollution from $CO_2$ and $SO_2$. Thus ethanol from sweet sorghum may be used as a non-conventional energy source. States like Andhra Pradesh, Maharashtra, Karnataka, Tamil Nadu and Gujarat have major area and production of sorghum. In Gujarat, it occupies an area of about 1.22 million hectares with annual production of 1.359 million tons (Anonymous, 2010).

## MATERIAL AND METHODS

The present investigation was carried out to assess the correlation and path analysis by using different promising germplasm lines and varieties of dual purpose sorghum. The experiment was conducted at Centre for Crop Improvement S.D. Agricultural University, Sardarkrushinagar during summer of 2010-11. The experimental material for present investigation comprised of 37 diverse genotypes of dual purpose sorghum obtained from the germplasm maintained at Sorghum Research Station, Deesa, S.D. Agricultural University, Sardarkrushinagar. The experiment was laid out in a Randomized Block Design (RBD) with four replications. The experimental plot consisted of one row of 5 meter length with row to row spacing of 45 cm and plant to plant spacing within a row was 15 cm. The experiment was shown on 15$^{th}$ February 2010. The observation

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**Table 1 : Genotypic and phenotypic correlation co-efficient for sixteen characters of sorghum**

| Characters | | DF | DM | PH | SG | NLP | LL | LW | NIP | AFL | PL | PD | PW | TGW | DFY | P%G |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| s | $r_g$ | 0.142 | 0.145 | -0.405** | 0.222* | 0.068 | 0.212* | 0.083 | -0.043 | 0.091 | 0.201* | 0.227* | 0.315* | 0.474** | 0.058 | 0.296* |
| | $r_p$ | 0.137 | 0.140 | -0.397** | 0.220* | 0.067 | 0.200* | 0.080 | -0.042 | 0.091 | 0.200* | 0.222* | 0.299* | 0.469** | 0.059 | 0.294* |
| DF | $r_g$ | | 0.961** | 0.043 | 0.621** | 0.296* | 0.657** | 0.251* | 0.403** | 0.433** | 0.193* | -0.081 | -0.222* | -0.065 | 0.338** | 0.224* |
| | $r_p$ | | 0.940** | 0.043 | 0.594** | 0.290* | 0.614** | 0.250* | 0.384** | 0.423** | 0.186 | -0.081 | -0.207* | -0.058 | 0.329* | 0.220* |
| DM | $r_g$ | | | 0.044 | 0.651** | 0.280* | 0.658** | 0.207* | 0.370** | 0.413** | 0.179 | -0.145 | -0.191 | -0.028 | 0.299* | 0.209* |
| | $r_p$ | | | 0.046 | 0.630** | 0.278* | 0.618** | 0.206* | 0.359** | 0.406** | 0.174 | -0.135 | -0.186 | -0.023 | 0.293* | 0.204* |
| PH | $r_g$ | | | | -0.036 | 0.407** | -0.058 | -0.218* | 0.313* | -0.179 | -0.363** | -0.114 | -0.210* | -0.432** | 0.177 | -0.385** |
| | $r_p$ | | | | -0.036 | 0.390** | -0.049 | -0.210* | 0.301* | -0.175 | -0.352** | -0.097 | -0.227* | -0.417** | 0.168 | -0.371** |
| SG | $r_g$ | | | | | 0.163 | 0.666** | 0.470** | 0.321* | 0.550** | 0.393** | 0.001 | 0.154 | 0.220* | 0.259* | 0.116 |
| | $r_p$ | | | | | 0.159 | 0.622** | 0.457** | 0.312* | 0.544** | 0.389** | 0.000 | 0.143 | 0.214* | 0.249* | 0.111 |
| NLP | $r_g$ | | | | | | 0.261* | 0.139 | 0.693** | 0.156 | -0.035 | -0.133 | -0.158 | -0.162 | 0.150 | -0.036 |
| | $r_p$ | | | | | | 0.244* | 0.133 | 0.679** | 0.154 | -0.035 | -0.130 | -0.154 | -0.160 | 0.148 | -0.034 |
| LL | $r_g$ | | | | | | | 0.421** | 0.229* | 0.761** | 0.542** | 0.002 | 0.085 | 0.219* | 0.580** | 0.057 |
| | $r_p$ | | | | | | | 0.407** | 0.802** | 0.717** | 0.510** | 0.013 | 0.067 | 0.210* | 0.541** | 0.051 |
| LW | $r_g$ | | | | | | | | 0.140 | 0.829** | 0.449** | 0.342** | 0.057 | 0.135 | 0.239* | 0.075 |
| | $r_p$ | | | | | | | | 0.134 | 0.802** | 0.436** | 0.327* | 0.057 | 0.131 | 0.226* | 0.068 |
| NIP | $r_g$ | | | | | | | | | 0.130 | 0.050 | -0.032 | -0.135 | -0.280* | 0.061 | -0.030 |
| | $r_p$ | | | | | | | | | 0.129 | 0.050 | -0.029 | -0.124 | -0.275* | 0.061 | -0.028 |
| AFL | $r_g$ | | | | | | | | | | 0.611** | 0.150 | 0.003 | 0.207 | 0.382** | 0.149 |
| | $r_p$ | | | | | | | | | | 0.605** | 0.147 | 0.003 | 0.205 | 0.376** | 0.148 |
| PL | $r_g$ | | | | | | | | | | | 0.197* | 0.203* | 0.251* | 0.268* | -0.119 |
| | $r_p$ | | | | | | | | | | | 0.193* | 0.197* | 0.248* | 0.256* | -0.115 |
| PD | $r_g$ | | | | | | | | | | | | 0.288* | 0.183 | 0.297* | -0.246* |
| | $r_p$ | | | | | | | | | | | | 0.271* | 0.179 | 0.291* | -0.237* |
| PW | $r_g$ | | | | | | | | | | | | | 0.252* | 0.062 | -0.079 |
| | $r_p$ | | | | | | | | | | | | | 0.247* | 0.059 | -0.073 |
| TGW | $r_g$ | | | | | | | | | | | | | | 0.105 | 0.262* |
| | $r_p$ | | | | | | | | | | | | | | 0.099 | 0.257* |
| DFY | $r_g$ | | | | | | | | | | | | | | | -0.269* |
| | $r_p$ | | | | | | | | | | | | | | | -0.264* |

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

DF: Days to 50% flowering, DM: Days to maturity, PH: Plant height, SG: Stem girth, NLP: Number of leaves per plant, LL: Leaf length, LW: Leaf width, NIP: Number of internodes per plant, AFL: Area of flag leaf, PL: Panicle length, PD: Panicle diameter, PW: Panicle weight,TGW: Thousand grain weight, DFY: Dry fodder yield, P%G: Protein per cent in grain, GY: Grain yield per plant.

Note: All the characters were recorded at physiological maturity except for DF.

recorded on the following characters *viz.*, days to 50 per cent flowering, days to maturity, plant height, stem girth, number of leaves per plant, leaf length, leaf width, number of internodes per plant, area of flag leaf and panicle length.

## RESULTS AND DISCUSSION

The estimates of correlation co-efficients among the different characters indicate the extent and direction of association. The correlation co-efficient provide a reliable measure of association among the characters and help to differentiate vital associations useful in breeding from those of the non-vital ones (Falconer, 1981).

The phenotypic and genotypic correlation co-efficients were worked out for grain yield per plant and other quantitative characters are presented in Table 1. In general the values of genotypic correlation were slightly higher than their phenotypic counterparts. This indicated that though there was a high degree of association between two variables at genotypic levels, its phenotypic expression was deflated by the influence of environment. Characters like panicle weight, thousand grains weight, protein per cent in grain and stem girth showed significant positive correlation with grain yield per plant at both genotypic and phenotypic levels. The present findings are in close conformity with that of plant height and stem girth in sorghum by Grewal *et al.* (1983) and Nimbalkar *et al.* (1988) who noticed for panicle weight and thousand grains weight. Patel *et al.* (1993) observed significant positive correlation of grain yield per plant with test weight which was in agreement with our results. Similar results were obtained by Umakanth *et al.* (2004), Bidve (2008), Madne (2008) and Jain *et al.* (2009) in sorghum.

Considering the findings of correlation co-efficients and direct and indirect effects of different yield components on grain yield per plant (Table 2), it may be concluded that thousand grain weight and panicle weight influence predominantly and therefore, be considered as direct yield contributing characters. These characters also had high heritability, high expected genetic advance and high positive or negative correlation with grain yield per plant in sorghum. It would be worthwhile to give more emphasis on these characters during selection programme aiming to improve grain yield per plant in sorghum. Through information about the contribution of individual characters to grain yield per plant is of importance in planning a sound breeding programme for developing high yielding varieties. Path co-efficient analysis gives an indication of direct effects as well as indirect effects of inter related variables on yield.

Fifteen characters were considered as casual variables of grain yield, the high positive direct effect on grain yield per plant was that of stem girth, number of leaves per plant, leaf length, panicle length, panicle diameter, panicle weight, thousand grain weight, and fodder yield per plant. These findings are in accordance with the results obtained in

**Table 2 : Path co-efficient analysis showing direct and indirect effects of fifteen causal on grain yield per plant variables in sorghum**

| Sr. No. | Genotypes | DF | DM | PH | SG | NLP | LL | LW | NIP | AFL | PL | PD | PW | TGW | DFY | P%G | GC SY |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. | DF | 0.022 | 0.033 | -0.012 | 0.091 | 0.115 | 0.086 | -0.015 | -0.079 | -0.150 | 0.022 | -0.023 | -0.027 | -0.012 | -0.007 | 0.054 | 0.142 |
| 2. | DM | 0.058 | 0.062 | -0.013 | 0.097 | 0.110 | 0.086 | -0.013 | -0.073 | -0.144 | 0.021 | -0.039 | -0.024 | -0.005 | -0.006 | 0.050 | 0.145 |
| 3. | PH | 0.003 | 0.002 | -0.256 | -0.006 | 0.155 | -0.007 | 0.013 | -0.062 | 0.062 | -0.042 | -0.028 | -0.030 | -0.088 | -0.004 | -0.090 | -0.405** |
| 4. | SG | 0.037 | 0.022 | 0.010 | 0.116 | 0.063 | 0.087 | -0.028 | -0.064 | -0.192 | 0.046 | 0.000 | 0.019 | 0.045 | -0.005 | 0.027 | 0.222* |
| 5. | NLP | 0.018 | 0.015 | -0.108 | 0.024 | 0.405 | 0.034 | -0.008 | -0.139 | -0.055 | -0.004 | -0.037 | -0.020 | -0.034 | -0.003 | -0.008 | 0.068 |
| 6. | LL | 0.038 | 0.022 | 0.013 | 0.096 | 0.097 | 0.283 | -0.025 | -0.044 | -0.254 | 0.061 | 0.004 | 0.009 | 0.044 | -0.011 | 0.012 | 0.212* |
| 7. | LW | 0.015 | 0.007 | 0.058 | 0.070 | 0.053 | 0.057 | 0.036 | -0.028 | -0.284 | 0.052 | 0.094 | 0.007 | 0.028 | -0.005 | 0.016 | 0.08 |
| 8. | NIP | 0.024 | 0.013 | -0.083 | 0.048 | 0.270 | 0.030 | -0.008 | -0.228 | -0.046 | 0.006 | -0.008 | -0.016 | -0.058 | -0.001 | -0.007 | -0.043 |
| 9. | AFL | 0.026 | 0.014 | 0.048 | 0.083 | 0.061 | 0.100 | -0.049 | -0.026 | -0.519 | 0.072 | 0.042 | 0.000 | 0.043 | -0.008 | 0.036 | 0.091 |
| 10. | PL | 0.011 | 0.006 | 0.097 | 0.060 | -0.014 | 0.071 | -0.027 | -0.010 | -0.214 | 0.133 | 0.056 | 0.026 | 0.052 | -0.005 | -0.028 | 0.201** |
| 11. | PD | -0.005 | -0.005 | 0.027 | 0.000 | -0.051 | 0.002 | -0.020 | 0.006 | -0.052 | 0.023 | 0.305 | 0.035 | 0.038 | -0.006 | -0.058 | 0.227* |
| 12. | PW | -0.013 | -0.007 | 0.063 | 0.022 | -0.061 | 0.009 | -0.003 | 0.025 | -0.001 | 0.023 | 0.078 | 0.120 | 0.052 | -0.001 | -0.018 | 0.315* |
| 13. | TGW | -0.004 | -0.001 | 0.115 | 0.033 | -0.063 | 0.029 | -0.008 | 0.056 | -0.073 | 0.030 | 0.052 | 0.032 | 0.200 | -0.002 | 0.062 | 0.474** |
| 14 | DFY | 0.020 | 0.010 | -0.046 | 0.038 | 0.059 | 0.076 | -0.014 | -0.012 | -0.133 | 0.031 | 0.084 | 0.008 | 0.021 | -0.056 | -0.064 | 0.058 |
| 15 | P%G | 0.014 | 0.007 | 0.103 | 0.017 | -0.013 | 0.007 | -0.004 | 0.006 | -0.052 | -0.014 | -0.068 | -0.010 | 0.054 | 0.006 | 0.266 | 0.296* |

Residual effect = 0.500 * and ** indicates significance of value at P = 0.05 and 0.01, respectively.

DF: Days to 50% flowering, DM: Days to maturity, PH: Plant height, SG: Stem girth, NLP: Number of leaves per plant, LL: Leaf length, LW: Leaf width, NIP: Number of internodes per plant, AFL: Area of flag leaf, PL: Panicle length, PD: Panicle diameter, PW: Panicle weight, TGW: Thousand grain weight, DFY: Dry fodder yield, P%G: Protein per cent in grain, GCSY: Genetic correlation with grain yield.

sorghum by Raut *et al.* (1994), Potdukhe (1993), Patel *et al.* (1993), Iyanar *et al.* (2001), Veerabhadiran and Kennedy (2001), Khairnar (2007) and Madne (2008).

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