Electronic Journal of Plant Breeding, 1(3): 315-318 (June 2010)

Research Note

Correlation and path analysis in sorghum (*Sorghum bicolor* L. Moench)

R. Prakash, K. Ganesamurthy, A. Nirmalakumari and P. Nagarajan

Abstract :
An investigation was carried out with 12 parents and their 35 hybrids (L x T mating design) of sorghum to asses association of fodder yield components and their direct and indirect effects on green fodder yield per plant. Results of correlation analysis indicated that the green fodder yield per plant was found to be significantly and positively correlated with plant height, number of tillers, leaf length, leaf breadth, stem diameter, hydrocyanic acid and crude fibre. Days to 50 per cent flowering, crude protein, and *in vitro* dry matter digestibility showed a negative association with green fodder yield per plant. Path analysis showed that plant height contributed high direct effect to green fodder yield per plant followed by leaf breadth (Moderate) and leaf length (Moderate). Stem diameter and *in vitro* dry matter digestibility also exerted positive direct effect on green fodder yield. Thus, the present study indicated that the plant height, leaf length, leaf breadth and stem diameter are important characters in deciding the green fodder yield per plant. Hence these characters may be considered as selection indices in sorghum breeding programme.

Key words:
Sorghum, Fodder yield, Correlation, Path analysis

Sorghum is an important fodder crop in India and West Africa. Forage sorghum became very popular among the farmers due to its wide adaptation, rapid growth, high green and dry fodder, ratoonability, and tolerance to drought conditions. Sorghum is preferred over maize in *kharif* season because of its high tolerance to various stresses and its superiority to pearl millet in having lower oxalate and fibre content. Sorghum stover is valued over all other sources of fodder (paddy straw, millet straw and wheat straw). Thus, sorghum is also used as fodder to the domestic animals for its better performance. The foremost objective is to develop genotypes capable of producing more biomass (green and dry) rather than specific economic traits like grain yield, fibre and oil content. The forage should be nutritionally superior such as better in palatability, high in protein, digestibility and low in toxic constituents in order to obtain better animal performance. Further, these economic characters are not only polygenically controlled but also considerably influenced by the fluctuating environmental conditions. Hence, an attempt was made to study the correlation and path analysis in 12 parents and their 35 hybrids (L x T mating design) of sorghum.

Centre for Plant Breeding and Genetics, Tamil Nadu Agricultural University, Coimbatore- 641 003.
Email: prakashmscagri@gmail.com

The present field experiment on sorghum (*Sorghum bicolor* L. Moench) was conducted in Millet Breeding Station (MBS), fodder quality analysis was conducted in Department of Forages, Tamil Nadu Agricultural University (TNAU), Coimbatore and *in vitro* dry matter digestibility (IVDMD) analysis was conducted at Department of Animal Nutrition, Tamil Nadu Veterinary and Animal Sciences University (TANUVAS) Chennai, during 2007 - 2009. The parent material was obtained from Department of Millets, Coimbatore. A total of thirty five F_1 hybrids along with twelve parents (seven lines *viz*., ICSA 547, ICSA 403, BJ 3 A, ICSA 693, ICSA 374, ICSA 744, TNSPV 14094 and five testers *viz*., PKB 291, PKB 161, CSV 15-217, CSV15-310, and PKB 192) were evaluated in a field experiment under Randomised Block Design with three replications. Each entry was raised in one row of 4 m length adopting a spacing of 60 cm between rows and 15 cm between plants. The standard agronomic practices were followed throughout the period of crop growth.

The biometrical observations on fodder yield and other related components were recorded on five randomly selected plants from each entry per replication at the time of 50 % flowering. Simultaneously whole plant samples were taken from all entries for analyzing the important fodder qualities. The replication wise mean values of the genotypes were subjected to statistical analysis. Observations were recorded on the following

characters *viz.,* days to 50 per cent flowering, plant height, number of tillers, number of leaves, leaf length, leaf breadth, stem diameter, green fodder yield, hydrocyanic acid, crude protein, crude fiber and *in vitro* dry matter digestibility. The genotypic correlation co-efficients were worked out by following the method of Al-Jibouri *et al.* (1958). Path co- efficient analysis was done as suggested by Dewey and Lu (1959) to partition the genotypic correlation co-efficient into direct and indirect effects.

Knowledge of the relationship among yield components is essential for the formulation of breeding programme aimed at achieving the desired combinations of various components of yield. The estimates of correlation coefficients among the different characters indicate the extent and direction of association. The correlation co-efficients 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).

In the present investigation, correlation co-efficients were worked out among eleven characters. Results of correlation analysis indicated that the green fodder yield per plant was found to be significantly and positively correlated with plant height, number of tillers, leaf length, leaf breadth, stem diameter, hydrocyanic acid and crude fibre. A strong correlation of these traits with green fodder yield indicated that simultaneous improvement of all the characters is possible. This is in agreement with the reports by Hussain and Khan (1973), Sood and Ahluwalia (1989) and Sanderson *et al.* (1993) and Manickam and Vijendradas (1995). Days to 50 per cent flowering, crude protein, and *in vitro* dry matter digestibility showed a negative association with green fodder yield per plant. Such results are in concurrence with the results of Sanderson *et al.* (1993) and Moyer *et al.* (2003). Regarding inter correlations between different characters, plant height had positive correlation with number of tillers, leaf length, leaf breadth and crude fibre. Number of tillers had positive association with crude fibre. Number of leaves had positive correlation with stem diameter. Leaf length exhibited positive association with leaf breadth and stem diameter. Leaf breadth showed significant and positive correlation with stem diameter. Stem diameter exhibited significant positive relationship with hydrocyanic acid (Table 1).

Path analysis partitions the total correlation coefficient into direct and indirect effects and measures the relative importance of the causal factor individually. In the present study, green fodder yield was considered as dependent character and other characters were taken as independent characters. The component of residual effect of path analysis was 0.388. The higher residual effect indicated the inadequacy of the trait chosen for the path analysis. Plant height contributed high direct effect to green fodder yield per plant followed by leaf breadth (Moderate) and leaf length (Moderate). Stem diameter and *in vitro* dry matter digestibility also exerted positive direct effect on green fodder yield. High positive indirect effect was recorded by leaf length through plant height. Number of tillers exhibited moderate positive indirect effect through plant height. Moderate positive indirect effect was recorded by leaf breadth through plant height (Table 2). Thus, the present study indicated that the plant height, leaf length, leaf breadth and stem diameter are important characters in deciding the green fodder yield per plant. Hence these characters may be considered as selection indices in sorghum breeding programme.

References

Al-Jibouri, H.A., P.A. Miller and H.F. Robinson. 1958. Genotypic and environmental variances and covariances in an upland cotton cross of interspecific origin. Agron.J., 50:633-636.

Dewey, D.R and K.H. Lu. 1959. A correlation and path coefficient analysis of components of crested wheat grass seed production. Agron.J.,51: 515-518.

Falconer, D.S. 1981. Introduction to Quantitative Genetics. Second edition. Longman, New york.

Hussain, M.K. and M.A. Khan. 1973. Correlation studies in sorghum Sudan grass hybrid forage. SABRAO Newsl., 5: 51-53.

Manickam, S. and L.D. Vijendra Das. 1995. Heterosis for forage yield and quality in sorghum. Annals Agric. Res., 16(1): 110-113.

Moyer, J.L., J.O. Fritz and J.J. Higgins. 2003. Relationship among forage yield and quality factors of hay-type sorghums. Online. Crop Management doi:10.1094/CM-2003-1209-01-RS.

Sanderson M.A., F.R. Miller and R.M. Jones. 1993. Forage quality and agronomic traits of experimental forage sorghum hybrids. Forage Research in Texas, CRP-5258., pp:58-60.

Sood, B.C. and M.Ahulwalia. 1989. Character association studies in forage sorghum. Forage Res.,15(1): 16-24.

Table 1. Genotypic correlation coefficients between green fodder yield per plant and its component traits in sorghum

Characters	DFF	PH	NT	NL	LL	LB	SD	HCN	CP	CF	IVDMD	GFY
DFF	1.000	-0.292 *	-0.229	0.375 **	-0.135	-0.170	-0.005	-0.180	0.040	-0.123	-0.229	-0.153
PH		1.000	0.467 **	-0.024	0.628 **	0.446 **	0.159	0.086	-0.392 **	0.421 **	-0.247 *	0.768 **
NT			1.000	-0.060	0.123	0.198	-0.148	0.019	-0.001	0.296 *	0.112	0.280 *
NL				1.000	0.186	0.211	0.298 *	-0.135	0.203	-0.100	0.074	0.144
LL					1.000	0.524 **	0.298 *	0.023	-0.068	0.186	-0.198	0.712 **
LB						1.000	0.355 **	0.169	0.126	0.084	0.004	0.684 **
SD							1.000	0.263 *	-0.056	-0.087	-0.005	0.434 **
HCN								1.000	0.054	0.054	-0.029	0.257*
CP									1.000	-0.316 *	0.237	-0.151
CF										1.000	-0.285 *	0.381 **
IVDMD											1.000	-0.149
GFY												1.000

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

Note: DFF-days to 50 per cent flowering, PH- plant height, NT-number of tillers, NL-number of leaves, LL-leaf length, LB-leaf breadth, SD-stem diameter, HCN-hydrocyanic acid, CP-crude protein, CF-crude fiber, IVDMD-*in vitro* dry matter digestibility, GFY- green fodder yield

Table 2. Path coefficients of yield components on green fodder yield per plant in sorghum

Characters	DFF	PH	NT	NL	LL	LB	SD	HCN	CP	CF	IVDMD	Genotypic Correlation Co-efficient with Green fodder yield
DFF	0.141	-0.148	0.012	-0.015	-0.028	-0.047	-0.001	-0.022	0.003	-0.024	-0.023	-0.153
PH	-0.041	0.507	-0.024	0.001	0.132	0.123	0.030	0.011	-0.028	0.082	-0.025	0.768 **
NT	-0.032	0.237	-0.051	0.002	0.026	0.055	-0.028	0.002	0.001	0.058	0.011	0.280 *
NL	0.053	-0.012	0.003	-0.039	0.039	0.058	0.056	-0.016	0.015	-0.020	0.007	0.144
LL	-0.019	0.319	-0.006	-0.007	0.211	0.145	0.056	0.003	-0.005	0.036	-0.020	0.712 **
LB	-0.024	0.226	-0.010	-0.008	0.111	0.277	0.066	0.021	0.009	0.016	0.001	0.684 **
SD	-0.001	0.080	0.008	-0.012	0.063	0.098	0.187	0.032	-0.004	-0.017	-0.001	0.434 **
HCN	-0.025	0.044	-0.001	0.005	0.005	0.047	0.049	0.122	0.004	0.010	-0.003	0.257 *
CP	0.006	-0.199	0.001	-0.008	-0.014	0.035	-0.011	0.007	0.072	-0.062	0.024	-0.151
CF	-0.017	0.214	-0.015	0.004	0.039	0.023	-0.016	0.007	-0.023	0.195	-0.029	0.381 **
IVDMD	-0.032	-0.125	-0.006	-0.003	-0.042	0.001	-0.001	-0.004	0.017	-0.056	0.101	-0.149

RESIDUAL EFFECT = 0.388 * Significant at 5% level, ** Significant at 1% level

Note: DFF-days to 50 per cent flowering, PH- plant height, NT-number of tillers, NL-number of leaves, LL-leaf length, LB-leaf breadth, SD-stem diameter, HCN-hydrocyanic acid, CP-crude protein, CF-crude fiber, IVDMD-*in vitro* dry matter digestibility, GFY- green fodder yield