Journal of Pharmacognosy and Phytochemistry

Available online at www.phytojournal.com

E-ISSN: 2278-4136
P-ISSN: 2349-8234
JPP 2020; 9(1): 870-873
Received: 01-11-2019
Accepted: 03-12-2019

BV Vara Prasad
Associate Professor, Department of Genetics and Plant Breeding, College of Agriculture, Rajendranagar, PJTSAU, Hyderabad, Telangana State, India

V Sridhar
Scientist (Plant Breeding), Agricultural Research Station, Madhira, PJTSAU, Khammam District, Telangana State, India

Corresponding Author:
BV Vara Prasad
Associate Professor, Department of Genetics and Plant Breeding, College of Agriculture, Rajendranagar, PJTSAU, Hyderabad, Telangana State, India

Assessment of variability, correlation and path analysis for yield and yield related traits in yellow pericarp sorghum germplasm lines [*Sorghum bicolor* (L.) Moench]

BV Vara Prasad and V Sridhar

Abstract
The experiment was conducted under rainfed condition at Agricultural Research Station, Madhira during early *rabi* 2015-16 using 40 ICRISAT sorghum germplasm lines. Estimation of variation, phenotypic and genotypic correlations along with path analysis was calculated for the material under study. Plant height, ear length, straw weight and grain yield showed high genotypic and phenotypic coefficients of variation indicating their high degree of response to environment. Plant height showed positive significant association with days to 50% flowering, days to maturity, number of leaves per plant, leaf length, leaf width, 100 seed weight and grain yield per plant. Number of leaves per plant showed positive significant association with leaf length, leaf width, 100 seed weight and grain yield per plant. Path coefficient analysis revealed plant height exhibited positive direct effect coupled with positive significant correlation with grain yield per plant. Days to 50% flowering exhibited negative direct and negative indirect effects via., days to maturity, number of leaves per plant and leaf length. Number of leaves per plant exhibited positive direct effect as well as positive significant correlation with grain yield per plant.

Keywords: Correlation, path analysis, sorghum germplasm

Introduction
Sorghum, *Sorghum bicolor* (L.) Moench is an important staple food and feed crop in the semi arid regions of the world where it is grown under rainfed and irrigated conditions. It is the fourth most important crop followed by rice, wheat and maize. India is a major sorghum growing country in the world, ranks first in acreage and second in production next to United States of America. Sorghum crop exhibits considerable differences in plant traits, panicle and grain characteristics including physiological responses to selection and is highly influenced by environmental factors. Grain yield is a complex and quantitative character and is polygenically controlled by many genes. Selection on the basis of grain yield *per se* alone is not effective and efficient. Selection for grain yield has to be coupled with selection for other component traits for higher response and efficiency to selection for improving yield. Knowledge on association of component traits among themselves and with yield can improve the selection efficiency and response to selection in plant breeding.

The estimates of genetic variability indicated the amount of genetic variation present in the material which is necessary for sorghum breeding programmes. The correlation studies taken alone are often misleading and the actual dependence of grain yield on the correlated yield component characters needs confirmation, which can easily be untangled and unraveled by path coefficient analysis. The path coefficient analysis is simply a standardized partial regression coefficient and as such it measures the direct influence of one variable upon the other and permits the separation of correlation coefficients into components of direct and indirect effects. The present research was undertaken to study the correlations and path analysis in different germplasm lines of sorghum to develop a criterion for selection that could be effectively used for selecting the desirable genotypes or lines with high yield potential in future.

Materials and methods
The present experiment was conducted in deep black soil under rainfed condition at Agricultural Research Station, Madhira during *rabi* 2015-16 using 40 yellow pericarp sorghum germplasm lines received from ICRISAT. 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 following randomized block design with three replications.

A good and healthy crop was raised following recommended package of practices. Five randomly selected plants from each entry of every replication 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) [2] and Johnson *et al.* (1955) [6]. The simple correlation coefficient was subjected to path analysis (Dewey and Lu, 1959) [3]. The list of gemplasm lines used for the present study is depicted in Table 1.

Table 1: List of yellow pericarp sorghum genotypes included in the study

S. No	Genotype	S. No	Genotype
1	IS-10529	21	NSJB-6682
2	IS-21821	22	NSJB-6692
3	NSJB-6628	23	NSJB-6662
4	NSJB-6647	24	NSJB-6587
5	NSJB-6571	25	NSJB-6574
6	NSJB-6671	26	NSJB-6580
7	NSJB-6599	27	NSJB-6575
8	NSJB-6597	28	NSJB-6677
9	NSJB-6579	29	NSJB-6581
10	NSJB-6568	30	NSJB-6657
11	NSJB-6685	31	NSJB-6672
12	NSJB-6661	32	NSJB-6572
13	NSJB-6565	33	NSJB-6648
14	NSJB-6679	34	NSJB-6566
15	NSJB-6601	35	NSJB-6595
16	NSJB-6674	36	NSJB-6566
17	NSJB-6676	37	NSJB-6565
18	NSJB-6678	38	NSJB-6590
19	NSJB-6590	39	NSJB-6683
20	NSJB-6887	40	NSJB-6648

Results and Discussion

Considerable amount of variability was observed in the material under study (Table 2). Plant height, ear length, straw weight and grain yield showed high genotypic and phenotypic coefficients of variation indicating their high degree of response to environment. Plant height, straw weight and grain yield showed high values for heritability estimates indicating high degree of response to selection for these traits. Phenotypic and genotypic correlations were calculated for ten characters to know the nature of association existing among them, the results of which are presented in Table 3. Plant height showed positive significant association with days to 50% flowering, days to maturity, number of leaves per plant, leaf length, leaf width, 100 seed weight and grain yield per plant. Days to maturity showed positive significant association with days to maturity only. Number of leaves per plant showed positive significant association with leaf length, leaf width, 100 seed weight and grain yield per plant. This may be due to that the leaves contributed for higher photosynthates that resulted in more of dry matter production that enhanced seed weight and grain yield per plant. Leaf length exhibited positive significant association with leaf width. Grain yield showed positive significant association with 100 seed weight in the present investigation. The results revealed that there is scope for simultaneous improvement of these traits through selection. Simultaneous selection of those traits showing positive significant association with grain yield should be done for yield improvement in sorghum as it is quantitative in nature. Similar results for grain yield and its attributing traits were also reported by earlier workers *viz.*, Kumar *et al*., (2012) [7], Pahuja and Dharmveer (2013) [8], Jain and Patel (2014) [5] and Swamy *et al* (2018) [11].

Path coefficient analysis (Table 4) revealed that plant height exhibited positive direct effect coupled with positive significant correlation with grain yield per plant (Fig 1). Positive indirect effects were manifested through days to 50% flowering, days to maturity, number of leaves per plant, leaf length, leaf width and 100 seed weight. Days to 50% flowering exhibited negative direct and negative indirect effects via., days to maturity, number of leaves per plant and leaf length. Number of leaves per plant exhibited positive direct effect as well as positive significant correlation with grain yield per plant. Straw weight showed negative direct effect and negative correlation with grain yield per plant. Higher indirect values could most likely be neutralized by negative indirect effects through other characters and this can lead to their low and non significant correlation with grain yield per plant. These results are in agreement with the earlier findings of Arunkumar (2013) [1], Irradi *et al*., (2013) [4] and Soujanya *et al* (2018) [10]. The results of path analysis indicated that plant height, days to maturity and number of leaves per plant showed highest positive direct effects along with positive significant correlation with grain yield in the present material under study. Thus, the present study indicated that the plant height, days to maturity and number of leaves per plant are important characters in deciding the grain yield per plant in the present material under study.

Table 2: Variability estimates for ten traits in yellow pericarp sorghum germplasm lines

	Plant height	Days to 50% flowering	Days to maturity	No. of leaves per plant	Leaf length	Leaf width	Ear length	Straw weight	100 seed weight	Grain yield per plant
GCV	22.923	4.170	3.723	12.108	9.711	6.214	26.236	56.865	15.225	42.768
PCV	23.036	5.212	4.342	18.932	11.986	18.959	29.557	58.614	17.529	44.153
h^2 (broad sense)	0.988	0.640	0.735	0.409	0.656	0.107	0.788	0.941	0.754	0.938
GA (5%)	159.992	5.451	7.153	1.913	9.738	0.296	8.215	616.715	0.693	28.636
GA (1%)	205.038	6.986	9.167	2.452	12.479	0.380	10.527	790.354	0.899	36.699
GA as % of mean 5%	46.927	6.874	6.577	15.952	16.207	4.196	47.972	113.648	27.240	85.340
GA as % of mean 1%	60.140	8.809	8.429	20.443	20.770	5.377	61.478	145.646	34.910	109.368

Table 3: Correlation coefficient estimates for ten characters in yellow pericarp sorghum germplasm lines

Character	Plant height	Days to 50% flowering	Days to maturity	No. of leaves per plant	Leaf length	Leaf width	Ear length	Straw weight	100 seed weight	Grain yield per plant
Plant height	1.0000	0.3489*	0.3471*	0.8039**	0.3956*	0.5548**	0.0912	0.1885	0.3609*	0.4321**
Days to 50% flowering		1.0000	0.5077**	0.2667	0.2457	-0.0586	-0.0026	0.2448	-0.2626	0.0041
Days to maturity			1.0000	0.1092	0.2218	-0.5028**	0.3525	0.0700	0.0153	0.2737
No. of leaves per plant				1.0000	0.5147**	0.9781**	-0.0388	0.2962	0.3682*	0.3232*
Leaf length					1.0000	0.5832**	0.1313	0.0638	0.0366	0.0779
Leaf width						1.0000	-0.0133	0.5251**	-0.0989	0.2128
Ear length							1.0000	0.0090	-0.0223	0.1581
Straw weight								1.0000	-0.0648	-0.1533
100 seed weight									1.0000	0.3318*

Table 4: Path analysis estimates for ten traits in yellow pericarp sorghum germplasm lines

Character	Plant height	Days to 50% flowering	Days to maturity	No. of leaves per plant	Leaf length	Leaf width	Ear length	Straw weight	100 seed weight	Grain yield per plant
Plant height	0.3024	0.1055	0.1050	0.2431	0.1196	0.1678	0.0276	0.0570	0.1091	0.4321**
Days to 50% flowering	-0.1038	-0.2976	-0.1511	-0.0794	-0.0731	0.0174	0.0008	-0.0729	0.0782	0.0041
Days to maturity	0.0754	0.1103	0.2172	0.0237	0.0482	-0.1092	0.0766	0.0152	0.0033	0.2737
No. of leaves per plant	0.4048	0.1343	0.0550	0.5035	0.2592	0.4925	-0.0195	0.1491	0.1854	0.3232*
Leaf length	-0.0722	-0.0448	-0.0405	-0.0939	-0.1824	-0.1064	-0.0240	-0.0116	-0.0067	0.0779
Leaf width	-0.0812	0.0086	0.0736	-0.1431	-0.0853	-0.1463	0.0019	-0.0768	0.0145	0.2128
Ear length	0.0085	-0.0002	0.0328	-0.0036	0.0122	-0.0012	0.0931	0.0008	-0.0021	0.1581
Straw weight	-0.0424	-0.0550	-0.0157	-0.0666	-0.0143	-0.1181	-0.0020	-0.2248	0.0146	-0.1533
100 seed weight	-0.0594	0.0432	-0.0025	-0.0605	-0.0060	0.0163	0.0037	0.0107	-0.1645	0.3318*

Residual effect: 0.8262

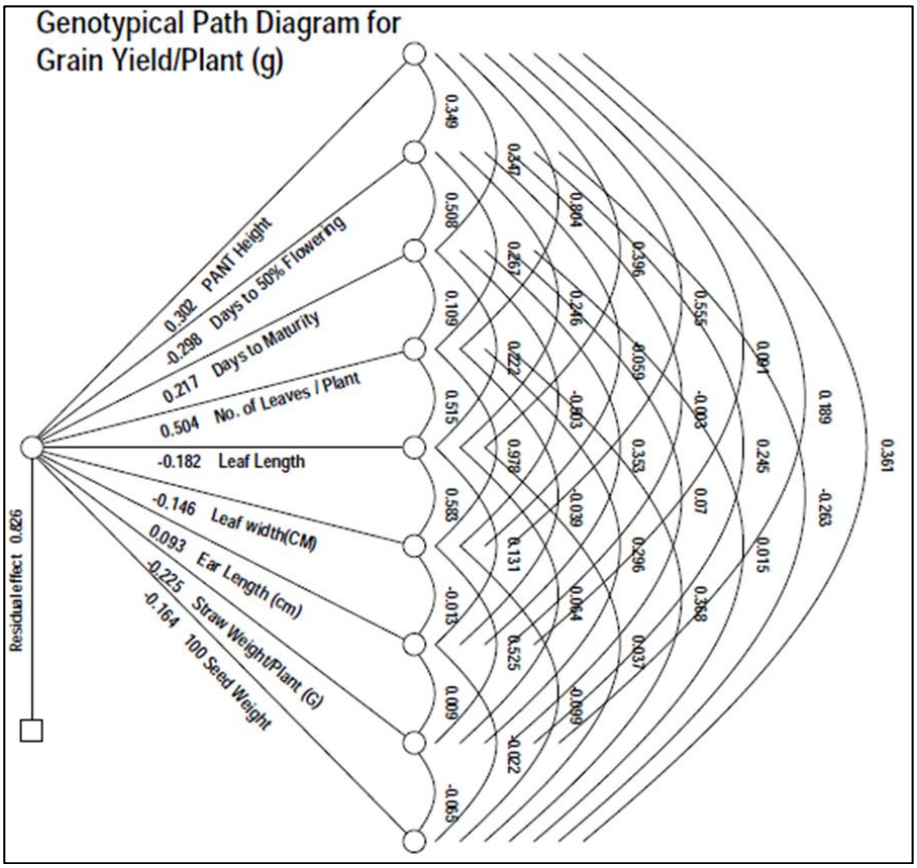

Fig. 1: Genotypic path diagram of nine traits with grain yield per plant in yellow pericarp sorghum germplasm lines

Residual effect determines how best the causal factors account for the variability of dependent factor, the grain yield per plant in this case. Its estimate being 0.8262, the variables (days to 50% flowering, days to maturity, number of leaves per plant, leaf length, leaf width, ear length, straw weight and 100 seed weight) explain only about 18% of variability in grain yield per plant. The reason seems to be very low and non significant correlations of days to 50% flowering and leaf

length with grain yield. Besides, some other factors which have not been considered here need to be included in this analysis to account fully for variation in grain yield per plant.

References

1. Arunkumar B. Genetic variability, character association and path analysis studies in sorghum (*Sorghum bicolor* (L.) Moench). The Bio scan. 2013; 8:1485-1488.
2. Burton GW. Quantitative inheritance in grasses. Proceedings of the 6th International Grassland Congress, 1952, 227-283p.
3. Dewey DR, Lu KH. A correlation and path coefficient analysis of components of crested wheatgrass seed production. Agron. J. 1959; 51:515-518.
4. Irradi V, Reddy TD, Umakanth AV, Rani C, Reddy DVV, Bhave MHV. Genetic variability, heritability and character association studies in sweet sorghum (*Sorghum bicolor* (L.) Moench). Journal of Research, ANGRAU. 2013; 41:30-38.
5. Jain SK, Patel PR. Character association and path analysis in sorghum (*Sorghum bicolor* (L.) Moench) F1s and their parents. Annals of Plant and Soil Research. 2014; 16:107-110.
6. Johnson HW, Robinson HF, Comstock RE. Genotypic and phenotypic correlations in soybean and their implications in selection. Agron. J. 1955; 47:477-483.
7. Kumar CVS, Umakanth AV, Kotastane TV, Sreelakshmi Ch. Character association and path analysis for qualitative traits in sweet sorghum (*Sorghum bicolor* (L.) Moench). Journal of Research, ANGRAU. 2012; 40:90-93.
8. Pahuja NB, Dharmveer SK. Correlation and path coefficient analysis for some DUS traits in forage sorghum (*Sorghum bicolor* (L.) Moench) genotypes. Annals of Biology. 2013; 29:127-131.
9. Patil CN, Rathod AH, Vanhela PO, Yadav SR, Patade SS, Shinde AS. Study of correlation and path analysis in dual purpose sorghum (*Sorghum bicolor* (L.) Moench). International Journal of Agricultural Sciences. 2014; 10:608-611.
10. Soujanya T, Shashikala T, Umakanth AV. Correlation and path analysis in sweet sorghum [*Sorghum bicolor* (L.) Moench] hybrids for green fodder yield and its components. Bulletin of Environment, Pharmacology and Life Sciences. 2018; 7(8):52-56.
11. Swamy N, Biradar BD, Sajjanar GM, Ashwathama VH, Sajjan AS, Biradar AP. Genetic variability and correlation studies for productivity traits in *Rabi* sorghum [*Sorghum bicolor* (L.) Moench], Journal of Pharmacognosy and Phytochemistry. 2018; 7(6):1785-1788