Madras Agric. J., 83(10): 625-628 October 1996
https://doi.org/10.29321/MAJ.10.A01066

GENETIC PARAMETERS, CORRELATIONS AND PATH ANALYSIS AMONG YIELD AND YIELD CHARACTERS IN GRAIN SORGHUM

R. SANKARAPANDIAN, D. KRISHNADOSS AND A.AMIRTHA DEVARATHINAM

Agricultural Research Station
Tamil Nadu Agricultural University
Kovilpatti 627 701

ABSTRACT

A population of 15 genotypes of grain sorghum varieties exhibited significant genotypic variation for ten characters selected in and around the ear head of the crop. The magnitude of PCV and GC were more or less equivalent for number of whorls per ear head, rachis per ear head, number of grains per ear head, 1000 grain weight and grain yield. These characters were less affected by environmental fluctuations whereas the character number of grain per earhead showed least or not affected by environmental changes. Seed density was remarkably masked by environmental components. Four among ten characters registered high values of heritability and genetic advance indicating the presence of addition gene effects. The grain yield showed no correlation with most of the component characters except with 1000 seed weight and number of grains per rachis which may be due to the elimination effects of one or other characters contributing for grain yield. This suggests that it is a complex character in the sorghum. Path analysis indicated that 1000 seed weight and number of grains per rachis are the prime characters for the improvement of genotypes.

KEY WORDS : Sorghum, Genetic Parameters, Correlation, Path Analysis.

Sorghum (*Sorghum bicolor* (L.) Moench) is one of most important crops of the *rabi* season in Tamil Nadu State. Grain sorghums are usually raised only during *rabi* season in the southern districts of Tamil Nadu utilising the North East Monsoon rains. Now grain sorghum is also used for many industrial uses. Normally the grain yield of the crop depends upon the size of the ear head, but in this study the characters selected are on the ear head itself and behave in different ways because yield is a complex characters. For evolving a suitable genotype, however, an idea on different genetic parameters is a pre-requisite. The grain yield is a sum total of contributions made by its individual components not only on the ear head but also on the other earhead traits. As a result of their interactions with environment, these components show wide range of variation. The main objective of the present investigation is for estimating the genetic parameters, inter correlations and to judge the direct and indirect effects of different yield component of grain grown in *rabi* season.

MATERIALS AND METHODS

Fifteen genotypes of grain sorghum were evaluated in a randomised block design with three replications, during *rabi* season 1993-94 at the Agricultural Research Station, Kovilpatti. Observations were recorded on five plants at [illegible] each replication. The characters studied were panicle length (cm), panicle breadth (cm), peduncle length (cm), number of whorls per earhead, number of grains per rachis, number of grains per earhead, 1000 grain weight (g) seed density (g/ml) and grain yield. Genotypic and phenotypic co-efficients of variation (GCV and PCV) were estimated by using the method by Burton (1952) and Johnson *et al.* (1955). The intercomponent correlation co-efficients were calculated as per Goulden (1952). Path analysis was worked out following the methods of Dewey and Lu (1959).

RESULTS AND DISCUSSION

Significant difference among the genotypes of grain sorghum suggested the presence of variability for all the ten characters under study (Table 1). In general, the magnitude of the PCV was higher than those of GCV for all the characters indicating the influence of environments on those characters. The highest magnitude of PCV was noticed for 1000 grain weight followed by peduncle length, panicle length and number of grains per rachis. The minimum PCV was noticed for number of grain/ear, seed density and grain yield. The GCV was highest for 1000 seed weight followed by peduncle length and panicle length as in the case of PCV. The lowest GCV was noticed for number of grains/ear, seed density and grain yield as noticed in the PCV. The magnitude of PCV and GCV were

Table 1. Genetic variability for ten yield component characters in grain sorghums

Source	Panicle length (cm)	Panicle breadth (cm)	Peduncle length (cm)	No. of whorls/ earhead	No. of rachis/ earhead	No. of grains/ rachis	No. of grains/ earhead	1000 seed weight (g)	Seed density (g/ml)	Grain yield (g/plant)
Mean	28.70	7.12	31.52	9.54	58.92	18.34	1699	27.01	1.73	44.62
Range	18.93 to 38.42	5.21 to 8.54	11.43 to 44.92	6.51 to 14.30	44.74 to 95.12	13.16 to 28.01	1281 to 1954	16.84 to 35.05	1.293 to 2.123	26.01 to 64.74
Mean Squares	193.81**	2.48**	246.42**	13.52**	397.82**	67.83**	0.91*	92.34**	0.20**	549.41**
V_p	67.63	0.89	84.33	4.68	135.43	24.03	46.40	394.63	0.08	2477.52
V_g	63.11	0.79	81.12	4.43	131.21	21.82	46.34	390.31	0.06	2467.11
V_e	4.52	0.10	3.21	0.25	4.22	2.21	0.06	4.32	0.02	10.41
H^2	93.32	88.83	96.21	94.65	96.88	90.80	97.87	98.90	75.0	99.57
PCV	28.65	13.24	29.15	22.77	19.75	25.67	0.004	73.57	0.21	1.12
GCV	27.68	12.48	28.59	22.15	19.44	25.53	0.004	73.17	0.03	1.11
G.A.	15.76	1.71	18.16	4.18	23.01	9.08	13.89	40.10	0.43	101.51
G.A. as % of mean	54.91	24.01	57.61	43.81	39.05	49.51	0.008	148.52	24.85	227.60

* Significant at 5% level ; ** Significant at 1% level

more or less equivalent for number of whorls per ear head, 1000 grain weight and grain yield. This showed that these characters were less affected by environmental fluctuation whereas the character number of grains per ear head showed that it was least or not affected by environmental changes. The character viz. Seed density recorded a wide range of difference in the magnitudes of PCV and GCV. This suggested that the expression of this character in grain sorghum genotype under study remarkably masked by environmental components. The characters like panicle length, panicle breadth and peduncle length showed little bit of differences in the magnitude of PCV and GCV indicating that these were also influenced by the environmental factors.

The heritability was highest (90%) for all the characters except for seed density and panicle breadth which registered 75.0 and 88.83 per cent respectively. A very high heritability of 99.87 per cent was observed for number of grains per ear head in this crop. Similar high heritability was reported by Nimbalkar *et al.* (1988) in grain sorghum. Grain yield and 1000 grain weight also showed high heritability of 99.57 and 98.90 per cent respectively compared to other characters which ranged from 90.80 to 96.88 per cent except density and panicle breadth which registered low heritability (Table 1).

The genetic advance as per cent of mean was highest for grain yield, 1000 grian weight, number of rachis, peduncle length and panicle length, High values of heritability associated with high values of genetic advance as per cent of mean suggested that these characters were under the control of additive gene action. Further, a considerable variation at phenotypic as well as genotypic level suggested scope for improvement of the crop in respect of

Table 2. Inter correlation among yield and its components in grain sorghum

	Panicle length	Panicle breadth	Peduncle	No. of whorls/ earhead	No. of rachis/ earhead	No. of grains/ rachis	No. of grains/ earhead	1000 seed weight	Seed density	Grain yield
Panicle length		0.667**	0.931**	0.141	-0.427	0.118	- 0.309	0.042	-0.201	-0.258
Panicle breadth			0.636**	-0.065	-0.384	0.167	-0.457*	0.193	-0.430	-0.011
Panicle length				0.122	-0.219	0.159	- 0.288	0.594*	0.012	-0.189
No. of Whorls					0.597**	-0.135	-0.295	0.338	0.444*	-0.079
No. of rachis						-.077	0.044	0.367	0.488	0.287
No. of grains/rachis							0.255	0.377	-0.370	0.596**
No. of grains/								-0.362	0.165	0.027
earhead1000 seed weight									-0.358	0.741**
Seed density										-0.395

* Significant at 5% level ; ** Significant at 1% level

Table 3. Path co-efficient analysis and correlations of yield and component characters

Characters	Panicle length	Panicle breadth	Peduncle length	No. of whorls/ earhead	No. of rachis/ earhead	No. of grains/ rachis	No. of grains/ earhead	1000 seed weight	Seed density	Correlation with gain/yield
Panicle length	-3.035	0.012	2.784	-0.009	-0.040	0.009	-0.039	0.029	0.030	-0.258
Panicle breadth	-2.254	0.016	2.045	0.010	-0.037	0.014	-0.064	0.115	0.062	-0.011
Peduncle length	-3.02	0.012	2.802	-0.010	-0.037	0.013	-0.039	0.038	0.027	-0.189
No. of whorls/ earhead	-0.11	-0.001	0.111	-0.262	0.056	-0.010	-0.039	0.250	-0.066	-0.079
No. of rachis/ earhead	1.298	-0.006	-1.126	-0.159	0.093	-0.005	0.004	0.275	-0.073	0.287
No. of grains/ rachis	-0.344	0.003	0.466	0.033	-0.006	0.081	0.034	0.273	0.056	0.596**
No. of grains/ earhead	0.916	-0.008	-0.836	0.077	0.003	0.021	0.132	-0.258	-0.024	0.027
1000 seed weight	-0.122	0.002	0.149	-0.090	0.035	0.031	-0.047	0.725	0.054	0.741**
Seed density	0.607	-0.006	-0.506	-0.115	0.045	-0.030	0.021	-0.257	-0.153	-0.395

Under lined figures denote the direct effects. Residual effect = 0.319

pancile length, peduncle length, nubmer of grains per rachis, 1000 grain weight and grain yield. Number of grains per ear head recorded high heritability but low genetic advance as per cent of mean. Seed density and panicle breadth registered low heritability and moderate genetic advance as per cent of mean which indicated that these characters were governed by the non-additive gene effects. Improvement for such important characters is possible by indirect selection method.

The results of inter-correlation was given in Table 2. Grain yield was significant and positively correlated with 1000 seed weight and number grains per rachis. Positive and non-significant correlation was noticed with number of rachis per ear head. Similar results were observed by Amirtha Devarathinam *et al.* (1990) in fodder sorghum. The grain yield recorded non-significant correlation with seed density, number of whorls, peduncle length, panicle breadth and panicle length. The seed density was significantly and positively correlated with number of rachis per ear head and number of whorls per ear head.

The 1000 grain weight had significantly and positive correlation with peduncle length. The number of grains per ear head was significantly and negatively correlated with panicle breadth. The number of whorls per ear head was significantly and positively correlated with number of rachis. Peduncle length recorded significantly high and positive correlation with panicle breadth and pancile length and they were seemed to be thickly interrelated. These inter relationship study revealed that though these characters are on the ear head itself, these traits will not directly bring out the yield out put and it depends upon other characters apart from the ear head traits, such as leaf area, root length etc., as reported by Sankarapandian and Subburaman (1986) in *rabi* sorghum. Path co-efficient analysis provided aid for sorting out the correlation in to direct and indirect effects in different characters on yield. The results exerted the highest positive direct effect on grain yield (Table 2).

Highest negative direct effect on yield was recorded by peduncle length. The highest direct effect of peduncle length on yield was nullified by the highest indirect effect through panicle length. Even though the correlation of number of grains per rachis was found significant and positive, its direct effect towards yield was very meagre. The direct and indirect effects through number of whorls were through out negligible. The association between panicle breadth and number of whorls with yield was negative and the direct effect on yield was also negligible.

It is inferred from path analysis that 1000 seed weight which recorded significant positive correlation co-efficient and also high positive direct effect might be regarded as the prime character. Similar information was reported by Shanmugasundaram and Subramaniam (1990) in sorghum. The indirect effects of number of grains per rachis through peduncle length was high contributed to its positive significance on yield. Hence simultaneous selection of number of grains per rachis be effective in obtaining superior genotypes.

REFERENCES

AMIRTHA DEVA RATHINAM, A., SANKARAPANDIAN, R. and NATARAJAN, M. (1990). Estimates of genetic parameters and correlation coefficients in fodder sorghum. **Madras Agric., J., 77** : 462 - 464.

BURTON, G.W. (1952). Quantitative inheritance in grasses. **Proc. 6th Int. Grass land Cong., 1** : 277 - 288.

DEWEY, J.R. and LU, K.H. (1959). Correlation and path analysis of components of created wheat grass seed production. **Agron. J., 51** : 515 - 518.

GOULDEN, C.H. (1952). **Methods of Statistical Analysis.** John Wiley and Sons, New York.

JOHNSON, H.W., ROBINSON, H.F. and COMSTOCK, R.E. (1955). Estimates of genetic and environmental variability in soybeans. **Agron. J., 47** : 314 -318.

NIMBALKAR, U.S., BAPAT, D.R., PATIL, R.C. (1988). Genetic variability, inter relationships and path co-efficients of grain yield and its attributes in sorghum. **J. Maharashtra agric. Univ., 13** : 207 - 208.

SANKARAPANDIAN, R. and SUBBURAMAN, N. (1986). **Heterosis and Combining Ability in Sorghum.** M.Sc.(Ag.), Thesis, Tamil Nadu Agricultural University, Coimbatore.

SHANMUGHASUNDARAM, P. and SUBRAMANIAN, A. (1990). Correlation and path analysis in sorghum (*Sorghum bicolor* L. Moench). **Madras Agric. J., 77** : 372 - 375.

(Received : March 1995 Revised : January 1996)

Madras Agric. J., 83(10): 628-631 October 1996

GENETIC VARIABILITY, CORRELATION AND PATH CO-EFFICIENT ANALYSIS OF JAGGERY YIELD AND RELATED ATTRIBUTES IN SWEET SORGHUM

R. SANKARAPANDIAN, S. RAJARATHINAM AND N. MUPPIDATHI

Regional Research Station
Tamil Nadu Agricultual University
Kovilangulam 626 107

ABSTRACT

The range of variation for different characters indicated wide differences among the genotypes both in main and ratoon crop. The phenotypic and genotypic co-efficient of variation was high for stem girth, length of fourth internode, total soluble solids and green stalk yield in main crop. High heritability and high genetic advance as per cent of mean for plant height, stem girth, length of fourth internode, green stalk yield, juice yield and jaggery yield both in main and ratoon crop indicated the presence of additive genes for these characters. Non-additive gene action was predominant for number of internodes in both main and ratoon crop. Juice yield showed strong positive correlation with jaggery yield in both main and ratoon crops. The juice yield had high positive direct effect in both main and ratoon crops. Hence, selection for high juice yield might be effective in achieving higher jaggery yield in sweet sorghum.

KEY WORDS : Sweet Sorghum, Yield, Jaggery Yield, Correlation, Path- analysis

Sorghum is mainly grown as rainfed crop and sweet sorghum (*Sorghum bicolor* (L.) Moench) is a special type used in preparation of jaggery. Jaggery can be manufactured from sweet sorghum stalks after harvesting the grain which provides additional income to the farmers. The stalks have been used upto 15 days after grain harvest without appreciable loss in quantity or quality of jaggery produced (Ghanekar, 1986). So, a thorough knowledge of existing genetic variation and extent of association between contributing characters is essential for developing high jaggery yielding genotypes. The observed variability is a combined measure of genetic and environmental causes. It is only the genetic variability that is heritable from generation to generation. Correlation and path analysis will establish the extent of association between jaggery yield and related attributes. It wil also bring out relative importance of their direct and indirect effects and give a clear idea of their association with jaggery yield. Thus it can help in selection and improvement of the traits. The present investigation in sweet sorghum is an attempt in this direction.