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Character association, genetic variability and component analysis in sweet sorghum [*Sorghum bicolor* (L. Moench)]

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ABSTRACT

To assess the extent of genetic variability and heritability of 12 genotypes and 4 standard checks of sweet sorghum (Sorghum bicolor (L.) Moench), the present experiment was conducted. The observations were recorded for 7 quantitative traits. The phenotypic co-efficient of variation (PCV) was greater than genotypic co-efficient of variation (GCV) for most of the characters studied indicating influence of the environmental effect on the characters. But the GCV values were close to PCV values for the characters like days to fifty per cent flowering, days to physiological maturity and grain yield, indicating very little effect of environment on the genotype, on the phenotypic expression for these traits. The genotypes under study showed high heritability for days to 50% flowering. High heritability combined with high genetic advance (as per cent of mean) was observed for grain yield, total biomass, days to 50% flowering, green cane weight. The correlation analysis indicating the days to 50% flowering. Days to physiological maturity showed significant positive association with plant height at 50% flowering and plant height at physiological maturity, while significant negative association was observed for grain yield.

***Keywords*:** Correlation coefficient, genetic variability, path analysis, *Sorghum bicolor*

Sorghum [*Sorghum bicolor* L. (Moench)] is an important food and feed crop in the semi-arid regions of the world where it is grown under rainfed and irrigated conditions. Sorghum is one of the main staple for the world's poorest and most food insecure people. The crop is genetically suited to hot and dry agro-ecologies, where it is difficult to grow other food grains and these are also areas subject to frequent drought. In Barani areas sorghum is truly a dual-purpose crop, both grain and stalk are highly valued outputs. Therefore, it can play a vital role for the uplift of socio-economic status of the farmers of Barani areas through development of high yielding varieties along with reasonable amount of dry fodder during winter season for the livestock. Sweet sorghum similar to grain sorghum with sugar rich stalk and water use efficiency and it is an alternative feed stock for ethanol production.

Yield is a complex character which depends upon several component characters. Therefore, direct selection for yield is often not effective. Thus, it is essential to study the association of yield components with yield which is less influenced by environmental factors. Path coefficient analysis (Wright, 1921) provides an effective means of finding direct and indirect causes of association. In the present investigation, genetic variability in quantitative characters, association of certain characters and their direct and indirect contribution to green cane yield is analysed. According to Briggs and Knowles (1967), the heritability of quantitative characters is usually high, because breeding behavior can be predicted. Furthermore, high heritability coupled with genetic advance indicates that additive gene effects are operating and selection for superior genotype is possible (Arunkumar *et al*., 2004). In addition to correlation and heritability the knowledge of genetic variability existing among different parameters contributing to yield is also an important criterion for yield enhancement.

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MATERIAL AND METHODS

The experiment comprising of 12 genotypes and 4 standard checks of sorghum was laid out in a randomized block design with three replications during *kharif* , 2005 at Sorghum Research Station farm, Marathwada, Krishi Vidyapeeth, Parbhani. Each genotype was sown with spacing of 60 and 15 cm. Normal agronomic practices recommended to the region were followed timely. Data on five randomly selected plants in each entry were collected for days to first flowering, plant height at 50% flowering, days to physiological maturity, plant height at physiological maturity, fresh cane weight at physiological maturity, total biomass at physiological maturity, Grain yield. The analysis of GCV and PCV were estimated by using the respective mean square from variance. (Joohnson *et al.*, 1995). Covariance analysis between all pairs of characters under study was carried out as per the analysis of variance and covariance as declared by Sing and Chowdary (1977).

RESULTS AND DISCUSSION

The analysis of variance revealed significant differences among the genotypes for all the seven characters under study. The GCV and PCV were comparatively high for grain yield (Table 1). Moderate values of GCV and PCV were observed for green cane yield, total biomass yield. The wider the differences between the values of GCV and PCV were observed for green cane yield and total biomass which indicated that this trait was that high influenced by environmental factors. High heritability values were recorded for days to 50% flowering and low at plant height at physiological maturity which indicates the selection was effective for all the traits except plant height at physiological maturity which indicated that selection was effective. A high estimate of heritability together with high genetic advance as percent of mean was recorded for grain yield, total biomass revealing the influence of additive gene action for these two traits. Hence, the improvement of these traits can be made through direct phenotypic selection. Johnson *et al.* (1955) suggested that heritability estimates along with genetic advance would be more useful in predicting yield under phenotypic selection than heritability estimates alone. High heritability is always not an indication of high genetic gain characters which showed high heritability coupled with wider variability would be successfully improved by direct selection. For plant height at 50% flowering, plant height at physiological maturity, days to physiological maturity, the high heritability estimates were accompanied by low genetic advance indicating non-additive gene action and breeding methods to exploit non-additive gene action like heterosis breeding may be tried for these three traits.

The genotypic and phenotypic correlation coefficients between yield and yield components are presented in table 2. The present study indicates that significant and positive correlation was observed between green cane yield and total biomass, plant height at physiological maturity and plant height at 50% flowering, days to 50% flowering showed significant positive association with day to physiological maturity indicating that there was

Table 1: Estimation of parameters of GV and PV for various characters in sweet sorghum

Sr. No.	Character	Range	GCV	PCV	H^2 (bs)%	Genetic advance as % mean
1.	Days to 50% flowering	81.33-104.33	7.64	7.95	92.3	15.12
2.	Days to physiological maturity	125-135.33	2.61	2.67	89.1	5.07
3.	Plant height at 50 per cent flowering (cm)	246.67-324	7.78	11.15	48.7	11.19
4.	Plant height at physiological maturity(cm)	252-340	7.90	11.70	45.6	10.99
5.	Green cane weight (t ha^{-1})	28.78-53.03	16.95	21.89	60	27.04
6.	Total biomass(t ha^{-1})	31.67-57.33	16.66	20.12	68.6	28.42
7.	Grain yield(Kg ha^{-1})	96.33-657.67	52.75	55.95	88.9	102.48

Table 2: Genotypic correlation coefficient for seven growth characters in sweet sorghum

Sr. No.	Genotypes	Days to 50% flowering	Days to physiological maturity	Plant height at 50% flowering	Plant height at physiological maturity (cm)	Green cane weight (t ha^{-1})	Total biomass (t ha^{-1})	Grain yield (Kg ha^{-1})
1.	Days to 50% flowering	1.000	0.946	0.425	0.439	0.374	-0.786**	0.330
2.	Days to physiological maturity		1.000	0.575*	0.604*	0.449	-0.675**	0.402
3.	Plant height at 50 per cent flowering (cm)			1.000	1.003**	0.935**	-0.253	0.947
4.	Plant height at physiological maturity(cm)				1.000	0.975**	-0.198	0.987**
5.	Green cane weight (t ha^{-1})					1.000	-0.214	1.005**
6.	Total biomass (t ha^{-1})						1.000	-0.199
7.	Grain yield (Kg ha^{-1})							1.000

***,* significant at 1%, 5% level respectively*

Table 3: Genotypic path analysis of six components on green cane yield in sweet sorghum

Sr. No.	Genotypes	Days to 50% flowering	Days to physiological maturity	Plant height at 50% flowering	Plant height at physiological maturity (cm)	Green cane weight (t ha^{-1})	Total biomass (t ha^{-1})	Grain yield (Kg ha^{-1})
1.	Days to 50% flowering	**0.0585**	-0.108	0.183	-0.155	0.366	-0.014	0.330
2.	Days to physiologicalmaturity	0.055	**-0.114**	0.248	-0.214	0.440	-0.012	0.402
3.	Plant height at 50 percent flowering(cm)	0.024	-0.066	**0.431**	-0.356	0.917	-0.004	0.947**
4.	Plant height at physiological maturity(cm)	0.025	-0.069	0.432	**-0.355**	0.957	-0.003	0.987**
5.	Total biomass (t ha^{-1})	0.021	-0.051	0.402	-0.346	**0.982**	-0.003	1.005**
6.	Grain yield (Kg ha^{-1})	-0.046	0.077	-0.108	0.070	0.070	**0.018**	-0.199

***,*significant at 1%, 5% level respectively, Bold figures indicates the direct effect, Residual effect =0.1173*

certain inherent relationship between these characters. Days to physiological maturity showed significant positive association with plant height at 50% flowering and plant height at physiological maturity while significant negative association was observed for grain yield. Plant height at 50% flowering was significantly associated with plant height at physiological maturity and total biomass yield. Similarly plant height at physiological maturity has significantly associated with total biomass yield. Therefore, desirable plant type in sweet sorghum should be more biomass yield, high plant height at 50% flowering and at physiological maturity.

The path coefficients analysis of yield components and their effect on yield are presented in Table 3. In the present study plant height at 50% flowering and total biomass yield had high positive direct effect on green cane yield at the same time these traits also had significant and positive association with green cane yield. The character plant height at 50% flowering had high positive indirect effect on green cane yield via plant height at physiological maturity and total biomass yield. Indicating importance of these two characters. Days to physiological maturity had high negative direct effect and it was positively correlated with green cane yield. Plant height at physiological maturity has high negative direct effect on green cane yield, its positive indirect effect via total biomass yield was also significant. The most desirable character in sweet sorghum should have less days required to 50% flowering, more biomass yield and more plant height at 50% flowering for more green cane yield.

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