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Original Research Article

Genetic Variability Studies in Sweet Sorghum [*Sorghum bicolor* (L.) Moench]

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A B S T R A C T

Genetic variability studies were worked out for fifteen characters in forty five genotypes of sweet sorghum [*Sorghum bicolor* (L.) Moench]. Based on Mean Performance the genotypes SSAVRT-1013, SSAVRT-1026, PVR-455, ICSV-93046, SPV-22 were found significantly superior over checks SSV-84 and RSSV-9.For all characters studied, phenotypic co-efficient of variation (PCV) was higher than the genotypic co-efficient of variation (GCV) indicating the influence of environment on the expression of these traits. The characters for green cane yield, total biomass, total soluble sugar, non-reducing sugar, reducing sugar and juice yield showed high value for genotypic and phenotypic co-efficient of variation also showed high estimates of heritability and expected genetic advance indicating presence of additive gene effect.

Keywords

Genetic, Sweet Sorghum, Variability

Introduction

At present sorghum is mainly used for grain and fodder. Sweet sorghum is one of the of common grain sorghum which are rich in sugar juice and can be used for sugar production. This crop is belongs to C_4 type of photosynthesis mature earlier under high temperature and short days. It is grown as a staple food throughout Asian and African countries and as a forage and fodder crop for livestock in developed countries like Australia. Cultivated sorghum are grouped in to four main types based on primarily use of sorghum viz., Grain sorghum, Sweet sorghum or Sorghos, Broom sorghum and Sudan grass etc. It also has greater potential for alcohol production by virtue of their high stem sugar concentration. In some developed countries it is used for preparation of syrup and alcohol for industrial purpose. Sweet sorghum has a potential to overtake sugarcane, if efforts are directed in developing hybrids with high sugar content and grain yield. Thus the present study was up to estimate the genetic variability for sugar percentage and juice yield in sweet sorghum genotypes.

Materials and Methods

The present investigation comprising 43 genotypes of sweet sorghum with 2 checks are evaluated for genetic variability among

them. This experiment conducted in randomized block design (RBD) with two replications. The observations recorded for 15 traits are *viz.*,days to 50% flowering, plant height at 50% flowering (cm), days to physiological maturity, plant height at physiological maturity (cm), fresh cane weight (ton/ha) at physiological maturity, total biomass(t/ha) at physiological maturity, grain yield (q/ha), brix at 15 days after flowering (soft dough stage), brix reading at physiological maturity, juice extraction percentage, juice yield (q/ha), P^H of juice, reducing sugar, total soluble sugar, non-reducing sugar. Observations were recorded on five randomly selected competitive plants in each genotype from each replication. The genetic information has been sought analysis of genetic variability, heritability in broad sense and genetic advance as percent mean was estimated according to Allard (1960). Phenotypic and genotypic co-efficient was estimated as per Burton (1952). Genetic advance as per percent mean was estimated according to Jonson *et al.,* (1955).

Results and Discussion

Analysis of variance revealed highly significant differences among the tested genotypes in respect of all the traits. The estimates of genotypic and phenotypic coefficient of variation were nearly equal for all quality characters studied in sweet sorghum. This indicated that variability for these characters was due to genetic factors and there was less influence of environmental factor in expression of these characters.

The variability parameters forty five genotypes of sweet sorghum presented in Table 1. In general, the estimates of PCV were higher than those for GCV. high estimate of GCV and PCV were observed for grain yield (38.86-40.56), reducing sugar (37.46-39.49), juice yield (27.43-28.00),juice extraction percentage (26.83-27.12), fresh cane weight (23.96-24.39), followed by non-reducing sugar (23.65-24.67),total soluble sugar (23.04-23.27) and brix at 15 days after flowering (22.06-24.98),total biomass (22.00-22.22), Higher estimates of genotypic and phenotypic coefficient of variation were observed for grain yield indicating more variability and scope for selection in improving this character similar results were found by Unche *et al.,* (2008b).

The estimates of genotypic and phenotypic coefficients of variance were nearly equal to days to 50 percent flowering, days to physiological maturity, plant height at 50 percent flowering and plant height at physiological maturity, indicating that the variability existing in these characters was due to genetic factors and there was less influence of environmental factor in the expression of these character. The similar results were reported by Rao and Patil (1996) for grain yield per plant. Veerbhadiran and Kennedy (2001) reported high GCV and PCV for grain yield.

In physiological traits high estimates of heritability were observed for all the characters studied. High estimate of genetic advance percent of mean were observed for characters viz., grain yield (76.71), fresh cane weight (48.49), total biomass (44.90), plant height at flowering (33.15) and plant height at physiological maturity (31.79).

The characters *viz*., grain yield, green cane yield and total biomass expressed high estimates of heritability accompanied with high genetic advance indicating additive gene action and thus selection for these characters in genetically diverse material would be more effective for desired genetic improvement.

Table.1 Variability parameters for fifteen characters in sweet sorghum

Characters	Range	Mean	GCV	PCV	ECV	Heritability	Genetic Advance
Morphological characters							
Days to 50% flowering	72.50-103.00	86.11	7.8521	8.1521	2.1909	92.78	15.5803
Days to physiological maturity	113.50-138.50	126.46	4.4019	4.664	1.5415	89.08	8.5582
Plant height at 50% flowering (cm)	172.40-367.10	278.68	16.1422	16.191	1.2557	99.40	33.1528
Plant height at physiological maturity (cm)	185.50-372.60	285.48	15.4821	15.5279	1.1918	99.41	31.7991
Fresh cane weight (t/ha) at physiological maturity	21.38-51.88	33.54	23.9647	24.3955	4.5642	96.50	48.4956
Total biomass(t/ha) at physiological maturity	23.82-55.19	36.64	22.0087	22.2225	3.0751	98.09	44.9017
Grain yield (q/ha)	2.09-9.22	5.42	38.8679	40.5681	11.6214	91.79	76.7122
Quality characters							
Brix at 15 days after flowering	8.00-19.67	12.13	22.0698	24.9808	11.7032	78.05	40.166
Brix at physiological maturity	9.33-20.50	14.63	18.3488	20.5887	9.339	79.42	33.6863
Juice extraction percentage	13.00-47.00	25.54	26.8972	27.1267	3.5214	98.31	54.9394
Juice Yield (l/ha)	2382-13450	9207	27.4346	28.0005	5.6008	96.00	55.3732
PH of juice	4.75-5.35	5.07	1.6663	2.2176	1.4633	56.46	2.5791
Reducing sugar (%)	0.21-1.78	0.78	37.4642	39.4993	12.5151	89.96	73.2
Non-reducing sugar (%)	8.16-18.80	12.91	23.654	24.6795	7.0406	91.86	46.7022
Total soluble sugar (%)	8.45-19.67	13.59	23.0401	23.2787	3.3237	97.96	46.9764

Potdukhe *et al.*, (1993) reported similar results for days to 50% flowering, Rao and Patil (1996) for green yield and Chaudhary *et al.*, (2001a) for biological yield.

In qualitative traits high estimates of heritability were observed for juice extraction percentage (98.31) followed by total soluble sugar (97.96), juice yield (96.00), non-reducing sugar (91.86), reducing sugar (89.96), brix at physiological maturity (79.42) and Brix at 15 days after flowering (78.05). High estimate of genetic advance as percent of mean were observed for characters viz., juice yield, juice extraction percentage, total soluble sugar, reducing sugar, non-reducing sugar, brix at 15 days after flowering, brix at physiological maturity. Thus, considering the estimate of GCV, heritability (b.s.) and genetic advance together, it is evident that brix at 15 days after flowering, juice extraction per cent, juice yield, reducing sugar, non-reducing sugar and total soluble sugar are most improvement characters.

Based on above discussion it is suggested that total biomass, green cane yield, juice yield, brix at physiological maturity are important characters.

The genotypes SSAVRT-1013, SSAVRT-1026, PVR-455, ICSV-93046, SPV-22 were found significantly superior over checks SSV-84 and RSSV-9 and can be used as material for future breeding programs.

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