

## Variability and Association Studies for Stover Yield in Sorghum [*Sorghum bicolor* (L.) Moench]

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Variability and path coefficient analysis were carried out in 130 germplasm lines of sorghum for stover yield and its components. The study revealed high estimates of PCV, GCV, heritability and genetic gain for number of leaves per plant and high estimates of PCV, GCV and moderate values of heritability and genetic gain were observed for panicle length. Stover yield exhibited positive and significant correlation with days to flowering, plant height, stem girth and green fodder yield per plot. Characters like plant height and stem girth, revealed high and positive direct effects on stover yield in path coefficient analysis. Germplasm lines Raj-20 and Raj-119 were found superior on the basis of per se performance.

**Key words:** Germplasm, Sorghum, Variability

Sorghum [*Sorghum bicolor* (L.) Moench] is a widely grown fodder crop in Rajasthan. Variability study for various yield-contributing characters is important for crop improvement. An attempt was made to access sorghum germplasm lines collected from various ecogeographic regions for evaluating genetic variability in some agromorphological traits.

### Materials and Methods

The experimental material included 130 germplasm lines collected from different sorghum-growing districts of Rajasthan and five checks (SU-45, CSV-10, SU-52, CSV-15, and CSH-6). The experiment was carried out in augmented randomized block design with 10 blocks at the experimental fields of Rajasthan College of Agriculture, Udaipur. The lines were sown in 5m row length with spacing of 45 cm x 15 cm. Observations were recorded on five randomly selected plants for the traits viz. plant height (cm), panicle length (cm), number of leaves, leaf

length (cm), leaf width (cm), stem girth (mm), 1000-grain weight (g), green fodder yield per plot (kg) and stover yield per plot (kg). For days to 50 % flowering and days to maturity observations were recorded on complete plot basis. The plot means were used for analysis of variance and later on variability parameters, correlation and path coefficients were calculated.

### Results and Discussion

Analysis of variance indicated that mean squares due to germplasm were significant for all the traits suggesting that experimental material possessed considerable variability. High magnitude of variation in the experimental material was also reflected by wider range for majority of traits. (Table 1).

For all the characters phenotypic coefficient of variation (PCV) was greater than genotypic coefficient of variation (GCV) indicating effect of environment on the expression of characters. However, trend of GCV

**Table 1. Range of mean performance of germplasm lines and checks in sorghum**

Character	Germplasm lines		Checks		CV (%)
	Range	GM	Range	GM	
Days to flowering	40.40-78.00	57.08	50.60-78.1	63.20	2.47
Days to maturity	83.00-304.70	95.11	84.80-112.40	97.10	7.32
Plant height	111.82-337.22	249.82	200.40-300.60	255.56	6.96
Panicle length	9.16-37.36	17.51	19-26.20	21.96	9.00
No. of leaves/plant	5.74-18.64	12.18	10.30-14.40	12.54	10.85
Leaf length	10.96-112.76	79.68	71.70-100.00	86.16	5.01
Leaf width	3.92-10.62	6.92	7.16-8.62	7.92	7.86
Stem girth	24.36-74.56	41.88	46.10-53.80	49.56	10.23
1000-grain weight	15.58-38.08	24.82	22.11-29.67	26.23	3.57
Green fodder yield	0.74-28.54	14.53	6.00-23.60	15.34	22.29
Dry fodder yield	0.87-16.80	6.04	2.09-7.18	4.87	25.90

and PCV was same. High estimates of PCV and GCV were observed for number of leaves per plant (59.69, 58.64) while for stover yield per plot (44.05, 41.23), green fodder yield per plot (41.23, 33.85) and panicle length (35.44, 33.59) estimates of PCV and GCV were moderate. High GCV for fodder yield was also reported by Patel *et al.* (1980). Heritability was high for days to flowering (98.24), number of leaves per plant (96.49), 1000-grain weight (93.62), days to maturity (91.13), leaf length (90.5) and plant height (90.11), while moderate

values were observed for panicle length (89.85), stem girth (82.72) and leaf width (82.59). Similar findings were reported by Nimbalkar (1987). The estimates of genetic gain revealed highest value for number of leaves per plant (118.66), whereas moderate values were obtained for dry fodder yield per plot (70.35), panicle length (65.60) and green fodder yield (57.25) (Table 2). The trait number of leaves per plant exhibited higher estimates of PCV, GCV, heritability and genetic gain; and panicle length showed high estimates of PCV, GCV and moderate values of heritability and genetic gain. Therefore selection is amicable for these traits.

**Table 2. Variability parameters for various traits in sorghum**

Character	PCV	GCV	H2	GG
Days to 50% flowering	20.64	20.46	98.24	41.78
Days to maturity	25.08	23.95	91.13	47.09
Plant height (cm)	22.64	21.49	90.11	42.02
Panicle length (cm)	35.44	33.59	89.85	65.60
Number of leaves/plant	59.69	58.64	96.49	118.66
Leaf length (cm)	17.58	16.72	90.50	32.77
Leaf width (cm)	21.56	19.60	82.59	36.69
Stem girth (mm)	29.14	26.50	82.72	49.65
1000-grain weight (g)	14.96	14.48	93.62	28.86
Green fodder yield/plot (kg)	41.23	33.85	67.41	57.25
Dry fodder yield/plot (kg)	44.05	38.79	77.53	70.35

The genotypic and phenotypic correlation coefficient showed similar trend (Table 3). Stover yield exhibited positive and significant correlation with days to flowering, plant height, stem girth and green fodder yield per plot at both genotypic and phenotypic levels, while with leaf length the correlation was positive and significant only at genotypic level. Henry *et al.* (1983) also reported similar findings for plant height and leaf length. The mutual association between these traits viz. days to flowering, plant height, leaf length, stem girth and green fodder yield per plot was positive and significant except of plant

**Table 3. Genotypic and phenotypic correlation coefficients between various traits in sorghum**

S.No.	Character	r	Days to maturity	Plant height (cm)	Panicle length (cm)	Number of leaves/plant	Leaf length (cm)	Leaf width (cm)	Stem girth (mm)	1000-grain weight (g)	Green fodder yield/plot (kg)	Dry fodder yield/plot (kg)
1.	Days to 50% flowering	g	0.392	0.573*	-0.022	0.431	0.660**	0.663**	0.876**	0.496*	0.961**	0.670**
		p	0.369	0.541*	-0.023	0.415	0.612**	0.589*	0.781**	0.479*	0.757**	0.576*
2.	Days to maturity	g		-0.079	-0.089	0.851**	-0.186	0.231	0.310	0.080	0.359	0.162
		p		-0.085	-0.068	0.786**	-0.159	0.191	0.234	0.067	0.304	0.142
3.	Plant height (cm)	g			0.093	-0.092	0.711**	0.212	0.405	0.244	0.758**	0.659**
		p			0.082	-0.070	0.657**	0.189	0.360	0.210	0.557*	0.521*
4.	Panicle length (cm)	g				0.007	0.113	0.218	0.102	0.112	-0.092	-0.141
		p				-0.012	0.095	0.219	0.117	0.092	-0.055	-0.113
5.	Number of leaves/plant	g					-0.129	0.315	0.361	0.111	0.428	0.308
		p					-0.128	0.298	0.349	0.093	0.368	0.292
6.	Leaf length (cm)	g						0.523*	0.705**	0.313	0.637**	0.533*
		p							0.448	0.593**	0.295	0.518*
7.	Leaf width (cm)	g							0.837**	0.434	0.547*	0.319
		p							0.813**	0.389	0.419	0.298
8.	Stem girth (mm)	g								0.493*	0.793**	0.551*
		p								0.447	0.589*	0.476*
9.	1000-grain weight (g)	g									0.422	0.349
		p									0.304	0.278
10.	Green fodder yield/plot (kg)	g										0.823
		p										0.810

\*, \*\* significant at 5% and 1% level of significance

Table 4. Path analysis indicating direct and indirect effects of various components on Stover yield in sorghum

S.No.	Character	Days to 50% flowering	Days to maturity	Plant height (cm)	Panicle length (cm)	Number of leaves/plant	Leaf length (cm)	Leaf width (cm)	Stem girth (mm)	Test weight (g)	Green fodder yield/plot (g)	r
1.	Days to 50% flowering	0.0704	-0.2260	0.4759	0.0063	0.3276	-0.1749	-0.1550	0.5590	0.0437	-0.2567	0.67
2.	Days to maturity	0.0276	-0.5769	-0.0656	0.0260	0.6467	0.0493	-0.0541	0.1982	0.0071	-0.0959	0.16
3.	Plant height (cm)	0.0403	0.0456	0.8306	-0.0271	-0.0695	-0.1885	-0.0496	0.2583	0.0215	-0.2025	0.66
4.	Panicle length (cm)	-0.0015	0.0513	0.0772	-0.2919	0.0056	-0.0301	-0.0510	0.0648	0.0098	0.0246	-0.14
5.	Number of leaves/plant	0.0304	-0.4910	-0.0760	-0.0021	0.7598	0.0343	-0.0737	0.2305	0.0098	-0.1143	0.31
6.	Leaf length (cm)	0.0465	0.1074	0.5908	-0.0331	-0.0983	-0.2650	-0.1222	0.4499	0.0275	-0.1700	0.53
7.	Leaf width (cm)	0.0467	-0.1335	0.1761	-0.0636	0.2394	-0.1385	-0.2338	0.5340	0.0383	-0.1460	0.32
8.	Stem girth (mm)	0.0616	-0.1791	0.3360	-0.0296	0.2743	-0.1868	-0.1956	0.6384	0.0435	-0.2119	0.56
9.	1000-grain weight (g)	0.0349	-0.0464	0.2030	-0.0326	0.0846	-0.0828	-0.1015	0.3148	0.0881	-0.1128	0.35
10.	Green fodder yield/plot (kg)	0.0677	-0.2070	0.6299	0.0269	0.3251	-0.1687	-0.1278	0.5064	0.0372	-0.2671	0.82

Res. effect: 0.5268

height with stem girth. Patel *et al.* (1973) also reported correlation between green fodder yield and plant height. So, simultaneous selection for these traits will help in improving the dry fodder yield.

Path coefficient analysis (Table 4) showed that out of five traits that exhibited significant positive correlation with stover yield per plot, only two traits, plant height and stem girth, revealed high and positive direct effects. The positive correlation of days to 50% flowering and green fodder yield per plot with stover yield was mainly due to indirect effects via stem girth whereas positive correlation of leaf length with stover yield per plot was chiefly contributed by indirect effect of plant height.

On the basis of mean performance, germplasm line Raj-20 was found superior as it exhibited high performance for Stover yield per plot (16.80 kg), green fodder yield per plot (26.54 kg), number of leaves per plant (17.74), leaf length (100.16 cm) and leaf width (8.30 cm). Other promising germplasm line was Raj-119 that expressed

high values for leaf width (10.62 cm), stem girth (74.56 mm) and green fodder yield per plot (26.14 kg).

On the basis of this investigation it can be concluded that direct selection is most effective for plant height and stem girth while indirect selection can be practiced for leaf length and green fodder yield per plot. Further, germplasm lines Raj-20 and Raj-119 could be utilized in future breeding programmes.

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