https://doi.org/10.29321/MAJ.10.A02308

Madras Agric J. 73 [9] : 517 – 520, September, 1986

ASSOCIATION ANALYSIS FOR DRY MATTER PRODUCTION AND DISTRIBUTION IN SORGUM

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Twelve advanced varieties of sorghum were studied for their genetic potentiality of dry matter production and its association with grain yield. The genotypes showed differential response to biomass production and grain yield. SPV. 351 was identified as the best. The dry matter accumulation in the panicle accounted for the major proportion of the total DMP. A positive correlation between total DMP and grain yield was established. Panicle dry matter had the largest direct effect on grain yield. Plant height was negatively associated with grain yield but its direct effect on grain yield was positive.

A knowledge on the inter-relationship between yield determining characters and their association with seed yield is of paramount importance in crop improvement for enhancement of yield. There has been remarkable breakthrough in increasing the yield potential of sorghum. However, an analysis of the dry matter accumulation in different components of the source and its relationship to the sink (grain) will certainly supplement the efforts made by the plant breeders for further improving the yield potential of this millet. With this objective, the present investigation was undertaken to study the total biomass production, its partitioning to different plant parts and their relationship with yield in sorghum.

MATERIALS AND METHODS :

The experimental material consisted of twelve genotypes of sorghum including five regional and two national varieties and five pre-release cultures. These cultivars were planted in a randomised block design replicated thrice. Observations were recorded on five randomly selected plants at maturity in each replication. The plant components were separated and air dried for removing the adhering moisture. Then the materials were dried at 70° C till uniform constant weight was obtained (48 hours). Data on mean single plant basis were utilised for statistical analysis. Correlation coefficients both at genotypic and phenotypic levels were computed according to Fisher (1954). Path co-efficient analysis was done according to the method used by Dewey and Lu (1959).

RESULTS AND DISCUSSION :

The mean DMP and the proportionate accumulation in various components and grain yield are presented in Table-1. Analysis of

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Table-1 Dry matter distribution in different plant parts

Genotype	Plant height (cm)	Root dry weight (g)	Stem dry weight (g)	Leaf dry weight (g)	Panicle dry wt. (g)	Total biomass (g)	Grain yield (g)
Co 18	136.0	26.9	65.6	22.7	70.0	185.2	46.8
SPV 346	165.0	23.1	65.4	25.7	60.7	174.9	34.0
TNS 23	163.3	13.0	46.2	11.8	29.5	100.5	17.7
Co 23	163.0	24.1	74.4	22.0	57.1	177.6	37.1
CS 3541	162.3	18.3	72.9	20.1	59.4	170.8	40.9
SPV 386	156.6	12.9	43.0	13.1	35.2	104.2	27.7
SPV 126	172.0	20.8	61.1	19.3	68.2	169.4	48.5
SPV 475	187.0	11.8	45.0	11.1	31.5	99.4	15.6
Co 24	159.0	12.4	37.6	13.8	38.9	102.7	26.2
Co 21	154.3	16.4	62.0	14.0	44.4	136.9	29.1
Co 22	115.3	26.1	78.9	27.0	63.0	195.0	41.0
SPV 351	143.6	24.3	76.6	22.8	85.8	209 5	63.3
SE		3.7	13.4	1.7	10.9		
CD		7.7	27.9	3.5	22.8		

variance revealed significant differences among the twelve genotypes for all the characters under study. Maximum biomass and grain production were observed in the variety SPV.351. The largest proportion of the total biomass produced was observed to be accumulated in the panicle, while the stem accounted for the next higher proportion of the biological yield.

The phenotypic and genotypic correlation coefficients are presented in Table-2. The grain yield in sorghum had strong association with the dry matter accumulated in the root, stem, leaf and panicle. The dry matter accumulated in the panicle had a significant positive association with that of root, stem and leaf both at phenotypic and genotypic levels. These findings are in conformity with those of earlier workers (Basu and Reddy, 1971, Patel *et al.* 1981) This close relationship suggested that selection of genotypes on the basis of panicle weight *per se* could produce superior types.

Results of path analysis are presented in Table-3. Panicle dry matter had the largest direct effect on grain yield than any other component. A similar observation was recorded by Kulkarni *et al* (1981).

Table-2 Correlation coefficients

	Root	Stem	Leaf	Earhead	Pl. ht	Glumes	Grain yield
Root	1.000	0.931**	1.030**	0.975**	—1.675**	1.034**	0.902**
		0 841**	0.823**	0.761**	—0.315	0.734**	0.657*
Stem		1.000	1.080**	0.980**	—1.768**	0.898**	0.918**
			0.680**	0.699**	—0.206	0.532*	0.619*
Leaf			1.000	0.899**	—1.464**	0.822**	0.805**
				0.750**	—0.340	0.722**	0.635*
Earhead				1.000	—1.498**	0.960**	0.977**
					—0.151	0.818**	0.964**
Pl. ht.					1.000	—1.469**	—1.673**
						0.245	—0.133
Glumes						1.000	0.903**
							0.744**
Grain yield							1.000

* Significant at 5 percent level.
** Significant at 1 percent level.

Upper row - Genotypic correlation coefficient.
Lower row - Phenotypic correlation coefficient.

Table 3 Direct and indirect effects

	Root	Stem	Leaf	Earhead	Pl. ht.	Glumes	Correlation with grain yield
Root	*—0.1407*	—0.3132	0.1895	1.8635	—0.4369	—0.2605	0.9027
Stem	—0.1310	*—0.3353*	0.1989	1.8740	—0.4613	—0.2263	0.9190
Leaf	—0.1450	—0.3633	*0.1863*	1.7191	—0.3820	—0.2071	0.8080
Earhead	—0.1372	—0.3289	0.1682	*1.9108*	—0.3910	—0.2418	0.9771
Pl. ht	0.2357	0.5932	—0.2689	—2.8643	*0.2608*	0.3700	—1.6735
Glumes	—0.1456	—0.3014	0.1510	1.8349	—0.3832	—0.2518	0.9038

The positive correlation between the panicle dry matter and grain yield (0.9771) was mainly due to its direct effect (1.9108). Eventhough the stem dry matter had a highly significant postive assocation with grain yield, its direct effect was negative. The high correlation was observed due to its indirect influence *via* leaf and panicle. Among the components studied, plant height revealed a negative association with grain yield. However, its direct effect on grain yield as well as indirect effects through roots and stem were positive. The negative correlation may be due to its higher indirect effect through panicle dry matter which was confirmed by the negative correlation between panicle dry matter and plant height. Similar observations were reported by Patel *et al.* (1980) in sorghum.

The dry matter accumulated in the roots also had no direct contribution to grain yield even though its correlation with grain yield was positive and significant. It influenced grain yield through leaf and panicle dry matter.

Thus the present study revealed that the panicle dry matter accounted for the major proportion of the total biomass for which there were genotypic differences. The panicle dry matter had the highest direct effect and the dry matter accumulated in root and stem had no direct influence on grain yield. Plant height tended to decrease yield. The variety SPV. 351 had the efficiency for high dry matter production and high grain yield.

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