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ANALYSIS OF GENETIC DIVERGENCE IN FODDER PEARL MILLET

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ABSTRACT

Genetic diversity in fodder pearl millet *(Pennisetum glaucum)* was studied with 28 genotypes of different origin. The genotypes could be grouped into 5 distinct clusters. The clustering pattern showed that geographic diversity is not an index of genetic diversity. Crude protein content, leaf weight and dry matter content were important contributors to the divergence. On the basis of genetic distance and cluster mean values, nine genotypes have been identified for hybridisation and selection for the desirable traits.

KEY WORDS : Fodder Pearl Millet, Genetic Divergence, Analysis

Genetic divergence as measured by Mahalanobis' (1936) generalized distance (D^2) has been one of the important statistical tools to provide a rational basis for selection of parents in breeding programmes. A number of pioneering workers (Moll *et al.*, 1962; Murthy and Arunachalam, 1966) have utilised this method of quantifying the degree of divergence between biological populations at the genotypic level and its role in breeding improved types. An attempt was made in this investigation to study the nature and magnitude of genetic divergence for green fodder yield and other related characters in fodder pearl millet *(Pennisetum glaucum)* genotypes.

MATERIALS AND METHODS

A set of 28 genotypes of fodder pearl millet obtained from the breeder, All India Co-ordinated Research Project on Forage Crops, Coimbatore were grown at the School of Genetics, Tamil Nadu Agricultural University during *rabi* 1991 in randomised block design with two replication. Selfed seeds of each genotype were sown with the spacing of 30cm between rows and 15cm between plants. Observation were made at the time of 50 per cent flowering from five randomly selected competitive plants for green fodder yield and its component characters. Representative plant samples from each replication were taken after the

Table 1. Composition of D^2 clusters.

Cluster Number	No. of Genotypes	Genotypes	Origin
I	14	AFB 6-12-2, AFB 48-1, AFB 52-12, AFB 4-1,	West Bengal
		NBH-7, UUJ.2	Maharashtra
		PCB 143, Comp 6, PCB 140, L72, PCB 139, PCB 141, L90,	Punjab
		ICMV 87111	Andhra Pradesh
II	10	Comp 9, L 74, Comp 8, PCB 87-24, LC 119-1,	Punjab
		HC 4,	Haryana
		APFB-2,	Andhra Pradesh
		AFB 27-8-10,	West Bengal
		C08,	Tamil Nadu
		NATH 211	Maharashtra
III	2	APFB-3, APFB-1	Andhra Pradesh
IV	1	ICMV-86104	Andhra Pradesh
V	1	RCB IC 9	Rajasthan

harvest for estimating quality parameters (dry matter content, ash content, crude protein content, crude fat content, crude fibre and oxalic acid contents). The mean values were transformed into uncorrelated linear functions for Mahalanobis' group distance (D^2) analysis (Rao,1952). The genotypes were grouped into clusters by Tocher's method (Rao, 1952) and there after the intra and inter-cluster distances were worked out.

RESULTS AND DISCUSSION

The analysis of variance revealed highly significant differences among 28 genotypes for all the 18 characters. By the application of clustering technique 28 types were grouped into 5 different clusters (Table 1). Among the five clusters, I was found to have as many as 14 genotypes representing different geographical regions and II had 10 genotypes. Of the remaining clusters, cluster III was represented by 2 genotypes and clusters IV and V were having only one genotype each.

The clustering of types according to geographic origin was observed in three out of five clusters. The clusters III, IV and V contained types from single geographical source. There were instances as in clusters I and II where genotypes from different geographical origin were grouped together in a single cluster. It was also observed that genotypes originating form the same place were found scattered in different clusters and therefore the different origin of the genotypes should not be considered as an indication of their divergence (Singh and Gupta, 1979; Singh *et al.* 1979; Bainiwal and Jatasra, 1980).

Considering the intra and inter-cluster distances (Table 2) the maximum inter-cluster distance (D=74.96) was recorded between clusters I and IV. It was noted that cluster I was highly divergent from cluster IV and cluster V. Other highly divergent cluster combination was cluster II with cluster V and indicated that hybridisation programme of genotypes belonging to these different divergent clusters might be used for

Table 2. Intra (Diagonal) and inter-cluster average of D^2 and D values (within parenthesis)

Clusters	I	II	III	IV	V
I	1240.54	2652.11	2386.04	5619.01	4272.16
	(35.22)	(51.50)	(48.85)	(74.96)	(65.36)
II		793.68	2096.95	3303.60	4493.62
		(28.17)	(45.79)	(57.48)	(67.03)
III			370.19	1431.08	1557.94
			(19.24)	(37.83)	(39.47)
IV				-	2040.16
					(45.17)
V					-

Table 3. Cluster means for eighteen charcters in fodder pearl millet.

Characters	I	II	III	IV	V
Plant height on the 30th day (cm)	42.22	42.62	51.19	50.65	45.94
Days to 50% flowering	49.00	47.50	51.00	51.50	50.50
Plant height at harvest (cm)	71.30	68.02	84.21	101.93	80.16
No. of tillers/plant	3.27	3.58	4.72	2.50	5.47
No. of leaves/plant	36.61	42.75	51.25	41.17	56.77
Leaf length (cm)	63.43	61.14	63.87	65.44	55.05
Leaf breadth (cm)	2.79	2.87	3.22	3.09	3.09
Stem diameter (cm)	0.93	0.90	1.02	0.93	0.94
Leaf weight (g)	53.78	62.64	87.34	49.17	83.17
Stem weight (g)	70.55	70.00	111.26	92.50	142.87
Leaf stem ratio	0.79	0.90	0.78	0.53	0.59
Green fodder yield/plant (g)	124.41	132.63	198.59	141.67	226.00
Dry matter content (%)	15.86	16.02	18.07	16.77	16.70
Ash content (%)	12.81	13.13	14.80	15.19	15.35
Crude protein content (%)	10.35	13.03	11.05	12.87	11.01
Crude fat content (%)	2.79	2.72	2.53	2.78	3.24
Crude fibre content (%)	25.10	22.74	23.84	24.68	24.22
Oxalic acid content (%)	1.81	1.85	1.90	1.85	2.04

Cluster	Characters	Genotypes
Cluster I	Low oxalic acid content	Comp.6
Cluster II	Leaf stem ratio, Crude protein content earliness and low crude fibre content	Comp.6 and LC 19-1; Nath.211;
Cluster III	Early vigour, leaf breadth, stem diameter, leaf weight, dry matter content	APFB-2; Co8
Cluster IV	Plant height and leaf length	APFB-3, APFB-1, ICMV-86104
Cluster V	Green fodder yield per plant, No. of tillers / plant, No. of leaves / plant, stem weight ash content and crude fat content.	RCB IC-9

exploitation of hybrid vigour and good recombinants. Lowest intra-cluster value (19.24) for cluster III indicated that the genotype included in the group showed closeness between them as compared to the type included in cluster I which showed maximum divergence within the group.

The cluster means of the various characters are represented in Table 3

Cluster IV, containing ICMV-86104 as the only genotype recorded the maximum mean for plant height at harvest and leaf length. Cluster V, having RCB IC-9, showed high mean values for no. of tillers/plant, no.of leaves /plant, stem weight, green fodder yield per plant, ash and crude fat contents. Cluster I and II recorded the minimum value for oxalic acid content and days to 50 per cent flowering respectively. Cluster II also showed maximum value for crude protein content. Cluster III recorded the maximum cluster mean for plant height on 30th day (early vigour), leaf breadth, stem diameter, leaf weight and dry matter content. Thus involving the following genotypes of outstanding mean performance from these clusters in the intervarietal and interspecific crosses will be useful in the development of high greed fodder yield per plant of high quality. Their segregating progenies are also likely to yield good recombinants for economic traits.

The relative contribution of different characters to genetic divergence showed that crude protein content contributed maximum (58.20%) followed by leaf weight (14.29%) and dry matter content (12.70%). The importance of dry matter content as contributing to genetic divergence has been brought about by Shukla and Dua (1983) in fodder pearl millet. This indicated that these attributes should form the criteria for selection of parents for hybridisation programme.

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EVALUATION OF SORGHUM GENOTYPES FOR CERTAIN PHYSIOLOGICAL CHARACTERS WITH YIELD AND INTERRELATIONSHIP ANALYSIS UNDER WATER STRESS CONDITION

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ABSTRACT

A total number of 21 sorghum varieties was screened for stress resistance at the vegetative stage of the crop. The grain yield was less affected compared to nonstress. The cultivars *viz.*, SPV 393, KS 7193, KS 6312 and TWC 120 were found to be drought tolerant after evaluating for most of the physiological characters and yield. The intercorrelation of ten characters showed that grain yield showed significantly positive correlation for number of closed stomata both in stress and nonstress condition. Highest non significant correlation was noticed for grain yield and leaf wilting/rolling, DMP/plant and stomata count under stress.

KEY WORDS : Sorghum, Physiological Characters, Yield, Stress, Non-Stress

Drought is a common occurrence for crops raised under rainfed cultivation. Sorghum withstand better drought and able to yield without failure. The yield of the crop depends upon the stages of crop growth where the drought or water stress occurred. Soil characters may also alter the water availability to the crop. The best growth is achieved by frequent fairly light irrigation rather than from infrequent heavy irrigation. Generally as the drought occurred later in the crops life, yield potential assumes a greater role in determining the genotypes for drought response, indicating the poor yield output. Hence, the performance of the crop in early drought can be assessed for selecting the genotype. The study also provides an opportunity to assess the effects of yield potential and certain physiological characters on genotype sensitivity to droughts of different kinds.

Table 1. Characters of experimental field
Soil fertility : 39.2 kg N/acre 6.4 kg p/acre 240.0 kg K/acre Water holding capacity : 34.1%
Moisture content at different stages of the crop

Vegetative stage (upto 35 days)			
Start of stress		End of stress	
DAS	Moisture content (%)	DAS	Moisture content (%)
10	20.4	20	18.1
		30	16.3
		35	14.4

MATERIALS AND METHODS

Twenty one cultivars of sorghum were evaluated at the Agricultural Research Station, Tamil Nadu Agricultural University, Kovilpatti during summer 1990- 91 in a randomised block design with three replications. The size of the plot was 3 x 2.7 m and distance from row to row and plant was 45 cm and 15 cm respectively. The experiment was laid out during rain free months of summer from April to July (after summer rains). The water stress was imposed by withholding irrigation immediately after life irrigation so as to induce drought artificially in the early vegetative stage of crop and then the crop was revived after the vegetative stage was over by irrigating to 50 per cent of available soil moisture level. Normal irrigations were given to the control plots. The data on soil properties and moisture of soil at frequent intervals are given in Table 1. Observation were