https://doi.org/10.29321/MAJ.10.A02672

*Madras agric. J* 70. (10): 678—680 October 1983

# GENETIC DIVERGENCE IN GRAIN SORGHUM

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Genetic divergence was assessed in 30 varieties of sorghum using $D^2$ statistics for eight characters related to yield. The population was grouped into 8 clusters. Clusters II, I and III were large and consisting more than two third of the total population. Days to maturity, plant height, ear girth and ear length were mainly responsible for genetic divergence. Clusters with small statistical distances were considered less diverse than those with large distances. Only genetically diverse lines with specific characters of interent and having high yield potential should be intercrossed. The varieties belonging to V and VII, respectively, were found genetically diverse and also of high yield potential and as such could be crossed with varieties belonging to II for evolving high yielding and early maturing varieties.

A knowledge of genetic diversity persent among populations and its quantitative assessment usually helps a breeder in choosing desirable parents for breeding programmes. The utility of multivariate analysis and the use of generalised distance ($D^2$) as a quantitat ve measure of genetic divergence are well illustrated in crop plants (Arunachalam & Ram, 1967; Cassie, 1963; Chandrasekariah *et al.* 1967). A multivariate analysis of the observed genetic variation among thirty promising cultures, using $D^2$ statistic is presented in this paper.

## MATERIAL AND METHODS

Thirty genotypes were selected from the germplasm collection maintained at Regional Research Station of Agriculture, Vallabhnagar, University of Udaipur, Udaipur. The experiment was laid out in randomized block design with three replication at the Botanical garden of Rajasthan College of Agriculture, in kharif season of 1974. The plot size consisted of two rows 4 m long Observation were recorded in five randomly selected plants in respect of days to 50% flowering, plant height, leaf number, ear length, ear diameter, test weight, grain yield/plant nd days to maturity. Mean of five plants for each character represented the value for a replication. Genetic diversity in relation to the above mentioned characters was studied using $D^2$ statistics as described by Rao (1952). Wilk's criterion was applied to test the differences over all characters.

## RESULTS AND DISCUSSION

The analysis of variance on the basis of plant mean revealed significant differences among the entries for all

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characters examined indicating thereby a considerable amount of variability for all the characters studied. Wilk's criteria revealed highly significant differences among the lines for the aggregate of the characters. The individual $D^2$ values corresponding to 435 possible comparisons, taking two genotypes at a time were computed. The thirty genotypes were clustered into eight groups/clusters formed on the $D^2$ values (Table 1). The clustering patterns and genotypes distribution are presented in Table 2. Cluster means for each character is presented in Table 3. The days to 50% flowering was highest in cluster V (83.8), plant height in cluster IV (250.7), leaf number in cluster VII (12.9) ear length in cluster V (29.9), ear diameter in cluster VII (26.0), test weight in cluster VII (3.8), grain yield/plant in cluster VII (79.9) and days to maturity in cluster V (130.3).

The maximum divergence occurred between clusters II and VII ($D^2$ = 1925.35), followed by IV - VIII (1643.6) V-VII (1331.94) and VI - VII (1177.88), while minimum between I & V (58.12). The maximum intra-cluster divergence occured in cluster IV. The genetic differences between the clusters were reflected in the cluster means. The clusters differed among each other for one or more character. It could also be said that single variety clusters (VII and VIII justified their separation into different clusters as they represented different plant type. An examination of characters chosen revealed the important contribution of plant height, days to maturity, ear length, ear diameter and leaf number to divergence. Similar results were also reported in sorghum by Murty and Arunachalam, 1967; Arunachalam & Ram, 1967.

Theoretically speaking the maximum amount of heterosis will be manifested in cross combinations involving the parents belonging to most divergent clusters. However, for a practical plant breeder, the objective is not only to get high heterosis but also to achieve high level of production and reducing the life span of the variety so that it can be fitted in the relay cropping pattern. In the present study the maximum distance existed between cluster II and VII. The mean yield of cluster II was somewhat low and, therefore, crosses involving the parents from this cluster may exhibit high heterosis together with earliness in maturity. Keeping this in view, it appears that the crosses between the varieties belonging to cluster II and VII, II and IV, and VI-VII will exhibit high heterosis as well as higher level of production.

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Table 1 Average inter and intera group $D^2$ values among 8 cluster comprising 3( varieties of *S. bicolor* (L,) Moench.

| Clusters | I | II | III | IV | V | VI | VII | VIII |
|---|---|---|---|---|---|---|---|---|
| I | 25.24 | 172.91 | 88.05 | 456.82 | 38.12 | 125.66 | 1047.18 | 398.69 |
| II | | 26.75 | 319.02 | 1037 32 | 146.93 | 179 81 | 1925.36 | 157.33 |
| III | | | 20.64 | 250.83 | 189 63 | 71.13 | 716.65 | 739.96 |
| IV | | | | 35.58 | 661.18 | 505 09 | 163.21 | 1643 60 |
| V | | | | | 21.55 | 210.79 | 1331.94 | 278.65 |
| VI | | | | | | 26.73 | 1117.88 | 580.13 |
| VII | | | | | | | — | 2683.62 |
| VIII | | | | | | | | — |

Table 2. Distribution of 30 *Sorghum bicolor* (L.) Moench varieties in different clusters.

| Cluster | Total no. | Varieties |
|---|---|---|
| I | 6 | R-24, 555, IS-1063, IS-6115, IS-4651, IS-4426 |
| II | 11 | IS-6090, PD 1-28, SP-685, R-1495, 285, M35-1, 431, 713, Swarna, 670-16 311 |
| III | 4 | 702, F9, 573, Pila Amla, Chittor |
| IV | 3 | IS-2252, Chittor local, Aispuri |
| V | 2 | PD 2-5, 461 |
| VI | 2 | 302, 173 |
| VII | 1 | Sultanpur |
| VIII | 1 | 2961 |

Table 3. Mean values of 8 clusters for cigit characters in *S. bicolor* (L.) Moench.

| Cluster | Days to 50% flowering | Plant heig-ht (cm) | Leaf num-ber | Eardia meter (cm) | Earlen gth (cm) | Test wei-ght (gms) | Grain yie-eld plant (gms) | Days to matu-rity |
|---|---|---|---|---|---|---|---|---|
| I | 70.6 | 185.1 | 12.1 | 18.3 | 17.5 | 2.4 | 61.0 | 119.2 |
| II | 66.7 | 145.5 | 10.8 | 14.9 | 22.2 | 2.5 | 53.9 | 110 9 |
| III | 72.9 | 164 6 | 12.1 | 18.3 | 18.4 | 3.3 | 58.0 | 123.9 |
| IV | 77.2 | 250.7 | 12.1 | 22.5 | 16.8 | 3 5 | 74.5 | 127 8 |
| V | 83.8 | 142.2 | 12.6 | 16.5 | 29.9 | 2 1 | 36.3 | 120.3 |
| VI | 73 7 | 146 6 | 11.9 | 16.6 | 26 5 | 3 5 | 57.56 | 117.5 |
| VII | 83.3 | 219.7 | 12 9 | 26.0 | 11.8 | 3 8 | 79.87 | 128.7 |
| VIII | 65.3 | 109.1 | 10.9 | 14.1 | 23.4 | 1.3 | 36.53 | 110.7 |