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# Genetic divergence in Guinea grass (*Panicum maximum* Jacq.)

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## Introduction

Guinea grass is ideal forage crop and grows well on a wide variety of soil and even under light shade of tree and bushes and can survive long dry spell and quick moving fires which does not harm underground root. In order to improve productivity, adaptability and quality of Guinea grass, it is important to understand the genetic diversity which exists in the population which also helps in their conservation and germplasm management (Tiwari and Chandra, 2010). The present study was undertaken to estimate the amount of diversity among 37 germplasm accessions (*Panicum maximum* Jacq.) and to identify diverse genotypes for breeding programmes for better yield and quality.

## Materials and Methods

The experimental material consisted of 37 accessions of Guinea grass (*Panicum maximum* Jacq.) obtained from various sources and maintained under AICRP (Forage Crops) at the College of Agriculture, Vellayani, Kerala. The accessions were planted using rooted slips at 60 x 30 cm spacing in RBD with two replications. All the agronomic practices were followed to maintain the crop stand. The biometrical observations recorded on single plant basis, from five plants of each entry were randomly selected. Average of these values was taken with respect to all biometrical characters. Mahalanobis $D^2$ Statistic (Mahalanobis, 1936) was employed to assess the genetic diversity and clustering of genotypes was done according to Tocher's method as described by Rao, 1952.

## Results and Discussion

The analysis of variance revealed highly significant differences among accessions for all characters under investigation, thereby indicating the presence of high genetic variability in the experimental material (Table 1). All genotypes were grouped into 7 clusters indicating large amount of genetic diversity existing among the accessions (Table 2). Among these 7 clusters, cluster 1 is the largest having 15 accessions, followed by cluster III having 14 accessions, cluster VII had 4 accessions, cluster II, cluster IV, cluster V and cluster VI had one accession each. The clustering pattern indicates that some genotypes belonging to same location got segregated into different clusters and certain genotype habituating different location got grouped in the same cluster. This leads to the inference that factors other than geographical diversity may be responsible for such clustering and that there is no parallelism between geographic and genetic diversity (Mannan *et al*., 1993 in colocasia, More *et al*., 2006 in fodder maize). The inter and intra cluster $D^2$ values among the clusters are presented in (Table 3). The intra cluster distance is lower than that of inter cluster distances showing that less diversity within cluster. The highest intra cluster distance was noted in cluster VII (9.42) and the minimum was in cluster IV, V and VI (0). The highest inter cluster distance is between cluster IV and VII (12.63). The genotypes belong to these clusters separated by high statistical distance would have greater genetic divergence and can be used for improvement of fodder yield and quality. Least inter cluster distance is between cluster I and cluster II (4.15). These are in accordance with findings of More *et al*. (2006). Hence Guinea grass has shown a wild range of diversity and there were few accessions with unique characters.

**Table 1:** ANOVA showing values of mean squares for different characters in Guinea grass

| Source of variat -ion | df | Days to flowe ring | Plant height (cm) | Leaf length (cm) | Leaf breadth (cm) | Leaf area index | Lengt h of intern -ode (cm) | Length of panicle (cm) | No. of till- ers per hill | No. leaves per hill | No. of panicle s per hill | Green fodder yield (t/ha) | Leaf-stem ratio | Wt. of seeds per hill (g) | Dry fodder yield (t/ha) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Repli -cation | `1 | 1.64 | 2.64 | 2.28 | 0.041 | 0.33 | 1.79 | 3.03 | 12.96 | 147 | 4.49 | 56.17 | 0 | 0.14 | 0.41 |
| Geno types | 36 | 44.67 *** | 304.27 ** | 87.86 *** | 0.055 *** | 4.29 *** | 3.94 ** | 69.19 *** | 103.64 *** | 2772.90 *** | 47.96 *** | 1317.69 *** | 0.11 *** | 14.55 *** | 76.08 *** |
| Error | 36 | 16.26 | 152.26 | 34.87 | 0.016 | 0.77 | 1.82 | 14.27 | 17.11 | 466.51 | 9.76 | 157.1 | 0 | 4.14 | 13.04 |
| F. value | | 2.74 *** | 1.99 ** | 2.51 *** | 3.38 *** | 5.53 *** | 2.16 ** | 4.84 *** | 6.05 *** | 5.94 *** | 4.91 *** | 8.38 *** | 3.49 *** | 3.51 *** | 5.83 *** |
| C.D. (5%) | | 5.65 | 17.29 | 8.27 | 0.17 | 1.23 | 1.89 | 5.29 | 5.79 | 30.27 | 4.37 | 17.56 | 0.3 | 2.85 | 5.06 |

* Significant at 5 per cent level ** Significant at 1 per cent level *** Significant at 0.1 per cent level

**Table 2:** Clustering pattern in 37 Guinea grass germplasm accessions

| **Cluster No.** | **Number of accessions** | **Accessions** |
|---|---|---|
| I | 15 | MC-14, PGG-192, PGG-251, PGG-9, MS-4685, PGG-316, MS-4732, PGG-195, PR-553, MS-4681, FR-426, PM-FR-600, PGG-227, FR-600, PGG-293 |
| II | 1 | MC-16 |
| III | 14 | PGG-205, PGG-14, MS-4690, MS-4675, MS-4691, Marathakam, MS-4733, Haritha, FP-553, PGG-277, PGG-202, PGG-327, MS-4687, PGG-200 |
| IV | 1 | PM-4728 |
| V | 1 | PGG-208 |
| VI | 1 | FR-428 |
| VII | 4 | PM-1188, MS-4688, Blue Guinea, MS-4600 |

**Table 3:** Average intra (In bold) and inter cluster $D^2$ distances

| **Cluster** | I | II | III | IV | V | VI | VII |
|---|---|---|---|---|---|---|---|
| I | **3.18** | 4.15 | 6.11 | 6.01 | 6.69 | 8.05 | 10.63 |
| II | 4.15 | **0.00** | 7.11 | 5.88 | 9.28 | 12.09 | 12.15 |
| III | 6.11 | 7.11 | **5.44** | 9.00 | 10.99 | 10.39 | 11.17 |
| IV | 6.01 | 5.88 | 9.00 | **0.00** | 8.27 | 6.69 | 12.63 |
| V | 6.69 | 9.28 | 10.99 | 8.27 | **0.00** | 6.56 | 11.57 |
| VI | 8.05 | 12.09 | 10.39 | 6.69 | 6.56 | **0.00** | 9.81 |
| VII | 10.63 | 12.15 | 11.17 | 12.63 | 11.57 | 9.81 | **9.42** |

**Table 4:** Cluster mean values for fourteen biometrical traits in Guinea grass

| **Cluster** | Days to flowering | Plant height (cm) | Leaf length (cm) | Leaf breadth (cm) | Leaf area index | Length of internode (cm) | Length of panicle (cm) | No. of tillers per hill | No. leaves per hill | No. of panicles per hill | Green fodder yield (t/ha) | Leaf-stem ratio | Wt. of seeds per hill (g) | Dry fodder yield (t/ha) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| I | 36.34 | 147.13 | 61.69 | 2.20 | 4.29 | 24.66 | 39.22 | 25.47 | 120.81 | 18.25 | 60.07 | 0.69 | 8.47 | 14.80 |
| II | 33.45 | 152.65 | 62.30 | 2.17 | 4.45 | 24.93 | 34.35 | 26.15 | 136.55 | 18.00 | 64.53 | 0.56 | 5.45 | 17.53 |
| III | 33.76 | 141.07 | 62.03 | 2.19 | 5.16 | 24.44 | 38.34 | 31.04 | 154.32 | 21.86 | 62.53 | 0.77 | 8.70 | 17.68 |
| IV | 37.30 | 146.80 | 56.75 | 2.17 | 3.25 | 24.12 | 36.35 | 22.15 | 103.40 | 16.70 | 100.00 | 0.74 | 9.25 | 24.34 |
| V | 40.50 | 154.10 | 75.30 | 2.36 | 5.86 | 26.99 | 44.60 | 25.00 | 113.10 | 18.70 | 82.81 | 0.53 | 12.80 | 21.59 |
| VI | 34.90 | 150.50 | 58.90 | 2.39 | 4.58 | 24.98 | 46.00 | 25.80 | 120.95 | 18.75 | 103.59 | 0.62 | 12.15 | 19.31 |
| VII | 35.31 | 151.06 | 64.49 | 2.44 | 5.07 | 24.39 | 47.71 | 25.65 | 127.88 | 16.91 | 82.38 | 0.96 | 8.00 | 20.27 |

## Conclusion

In the present investigation, it was concluded that Guinea grass displayed a wide range of diversity and there were few accessions with unique characters. Hence the accessions may be effective in future breeding programme for development of Guinea grass varieties with improved fodder yield and quality.

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