Based on cluster means, the clusters have been identified for selecting parents for future hybridization programme and accordingly, cluster III has been identified for selecting parents for incorporating early maturity, dwarfness, flag leaf area and harvest index; cluster IV for grains per spike, Cluster X for number of spikes per plant; cluster XI for spike length and bold seededness and cluster VI for grain yield per plant. The genotypes superior in the above clusters may be involved in a multiple crossing programme to recover transgressive segregants with high genetic yield potential.

It is observed that days to maturity, plant height, spikes per plant, grains per spike and harvest index is showing positive significant relationship with grain yield, so it is further suggested that spikes/ plant, grain yield and grain boldness may be used as a criteria for single plant selection in the early segregating generation derived from the multiple crosses among the selected genotypes. So, hybridization between genotypes of divergent clusters will lead to accumulation of favorable genes in a single variety and also it is suggested to create variability for developing the varieties involving a large number of divergent lines instead of closely related ones.

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# Variability, heritability and genetic advance studies in napier grass (*Pennisetum purpureum.* K. Schum.)

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**Abstract** : Genetic variability and heritability studies involving 53 genotypes of napier grass germplasm indicated that there were highly significant differences between the genotypes for green fodder yield and eight other characters. The genotypic and phenotypic coefficients of variation did not differ widely indicating the lesser influence of environment on the characters. High genotypic co-efficient of variation was observed for panicle length, number of tillers per plant, leaf width, stem thickness and leaf length. Heritability estimates in general were high for most of the characters studied. High heritability coupled with high genetic advance as per cent of mean was observed for panicle length, number of tillers per plant and leaf width. Hence these three characters need be given more importance in selection as these are expected to be controlled by additive genes. *(Key words : Napier grass, Variability, Genetic Advance)*

Napier grass is one of the important fodder grasses and is grown for green fodder purposes in many parts of the world. A green fodder crop of value should be in a position to give a large quantity of quality fodder in an unit space and time and as such importance is given to the fodder yield. Though rapid advances have been made in development of different food crop varieties, hybrids and composites, for grain purposes in India improvement of fodder crops has remained only as a secondary feature. Since there was very little emphasis on forage crop improvement in India, in the recent past, genetical research on these crops is scanty. Though napier grass is in cultivation throughout the world and a good variability is available, concerted efforts have not been made adequately to categorize the variability. Hence an attempt was made to study the variability for biometrical traits and a few quality characters within the genotypes before any further genetical research in the species is taken up, The present study was aimed to identify the genetic parameters that control the green fodder yield and other yield attributing factors as well as a few quality characteristics of the fodder, in order to identify the best genotypes of napier grass which can be further exploited for increased fodder yield and quality.

## Materials and Methods

Root slips of 53 genotypes of napier grass maintained in the Department of Forage Crops, Tamil Nadu Agricultural University, Coimbatore were planted in two replications adopting a spacing of 50 x 50 cm. Each genotype was planted in two rows of 6 m length per replication. Uniform cultural operations were followed. Observations were recorded on five plants selected at random in each genotype per replication, before harvest. The first harvest was done on the 60th day after planting and the second harvest was done 45 days later. The mean of the two observations was used to calculate the statistical parameters. The analysis of variance was done as per Panse and Sukhatme (1961). The genotypic and phenotypic variances as well as genetic advance were calculated as per Johnson *et al.* (1955). The phenotypic and genotypic coefficients of variation were estimated by the formulae given by Burton (1952). Heritability in broad sense was calculated according to Robinson (1966).

## Results and Discussion

Analysis of variance for the nine characters is given in Table 1. Highly significant differences were observed among the genotypes for all the traits, indicating the very high variability within the genotypes. The mean *per se* performance of the best fifteen genotypes is given in Table 2. For green fodder yield six genotypes recorded more than 100 g with the genotype FD. 440 recording the highest yield of 107.77 g. FD. 470 was the tallest (400.33 cm). The genotype FD. 431 had the longest (94.00 cm) and the broadest leaves (3.26 cm). The number of tillers was the highest in FD 447 (45.33). The crude protein content was the highest in FD. 464 (14.63 percent) and the crude fibre content was the highest in FD. 463 (33.13 percent).

The genotypic and phenotypic variances were highly significant for all the characters. Plant height recorded the highest values followed by leaf length and green fodder yield (Table 3). A major portion of the total variation

**Table 1.** Analysis of variance in fifty three genotypes of napier grass for nine different characters.

| Sl.No. | Characters | Mean sum of squares |
|---|---|---|
| 1. | Plant height | 5672.65** |
| 2. | Leaf length | 355.23* |
| 3. | Leaf width | 0.97** |
| 4. | Stem thickness | 0.54** |
| 5. | Number of tillers per plant | 263.83** |
| 6. | Panicle length | 295.91** |
| 7. | Green fodder yield | 456.31** |
| 8. | Crude protein content | 13.88** |
| 9. | Crude fibre content | 25.22** |

** Significant at P = 0.01 ; * Significant at P = 0.05

**Table 2.** Mean *per se* performance of the best fifteen genotypes of napier grass

| S No. | Genotype | Plant height (cm) | Leaf length (cm) | Leaf width (cm) | Stem thick-ness (cm) | No. of tillers per plant | Panicle length (cm) | Green fodder yield (g) | Crude protein content (%) | Crude fibre content (%) |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | FD 440 | 389.33 | 60.33 | 2.23 | 1.46 | 38.00** | 30.33** | 107.77** | 9.46 | 30.93** |
| 2 | FD 430 | 334.66 | 75.33* | 2.33* | 2.26** | 19.33 | 30.50** | 105.23** | 9.30 | 30.66** |
| 3 | FD 432 | 269.33 | 68.00 | 2.36* | 2.16** | 32.00* | 30.66** | 104.23** | 8.83 | 25.06 |
| 4 | FD 482 | 399.33** | 51.00 | 2.56* | 1.86 | 19.33 | 19.33 | 104.00** | 5.53 | 23.53 |
| 5 | FD 457 | 309.43 | 53.33 | 2.33* | 1.43 | 9.33 | 18.23 | 103.73** | 13.03* | 26.20 |
| 6 | FD 439 | 389.33** | 60.33 | 2.23* | 1.46 | 38.00** | 32.33** | 99.53* | 10.63 | 27.53 |
| 7 | FD 459 | 274.66 | 41.23 | 2.20* | 1.63 | 16.67 | 0.00 | 97.63* | 9.63 | 24.56 |
| 8 | FD 470. | 400.33** | 45.43 | 1.20 | 0.93 | 14.00 | 13.73 | 94.23 | .11.16 | 24.63 |
| 9 | FD 458 | 359.66 | 42.93 | 2.30* | 1.76 | 16.67 | 15.66 | 92.40 | 11.06 | 25.60 |
| 10 | FD 435 | 391.33** | 84.33** | 3.00* | 1.50 | 18.33 | 30.00** | 91.23 | 8.96 | 27.43 |
| 11 | FD 434 | 378.33* | 63.83 | 1.26 | 2.36** | 30.33* | 17.66 | 90.93 | 10.90 | 29.73* |
| 12 | FD 447 | 332.66 | 62.00 | 1.66 | 1.66 | 42.33** | 22.33** | 83.53 | 5.53 | 28.93 |
| 13 | FD 464 | 278.66 | 38.50 | 1.10 | 1.46 | 16.00 | 17.00 | 80.76 | 14.63* | 29.50* |
| 14 | FD 463 | 300.20 | 46.26 | 1.56 | 1.80 | 12.00 | 24.66** | 79.20 | 9.06 | 33.13** |
| 15 | FD 431 | 265.66 | 90.00** | 3.26** | 3.00** | 17.00 | 0.00 | 0.33 | 10.30 | 24.36 |

** Significant at P = 0.01; * Significant at P = 0.05

**Table 3.** Mean, variance, co-efficient of variability, heritability (broad sense) and genetic advance for different characters in napier grass genotypes.

| Sl. No. | Genotype | Mean | Range | Variance | | PCV (%) | GCV (%) | Heritability | Genetic advance | GA as % of mean |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Phenotypic | Genotypic | | | | | |
| 1 | Plant height (cm) | 282.88 | 178.67-400.33 | 2890.88 | 2317.05 | 17.63 | 15.78 | 80.15 | 88.77 | 3178 |
| 2 | Leaf length (cm) | 62.68 | 1.33 - 94.00 | 185.07 | 150.85- | 24.55 | .2.26 | 81.51 | 22.84 | 36.44 |
| 3 | Leaf width (cm) | 2.14 | 0.76 - 3.26 | 0.32 | 0.29 | 33.53 | 31.85 | 90.23 | 1.06 | 49.53 |
| 4 | Stem thickness (cm) | 1.72 | 0.76 - 3.00 | 0.18 | 0.16 | 28.05 | 26.70 | 90.54 | 0.79 | 45.93 |
| 5 | No. of tillers plant | *15.51* | 7.00 - 45.00 | 87.95 | 78.19 | 44.80 | 42.23 | 88.91 | 17.17 | 110.70 |
| 6 | Panicle length (cm) | 16.47 | 0.00 - 31.00 | 98.63 | 96.80 | 51.96 | 51.48 | 98.14 | 20.07 | 121.86 |
| 7 | Green fodder yield (g) | 84.53 | 57.60 - 107.77 | 152.10 | 125.06 | 15.15 | 13.74 | 82.20 | 20.90 | 24.72 |
| 8 | Crude protein | 10.25 | 5.40 - 14.63 | 4.62 | 4.12 | 21.90 | 20.70 | 89.27 | 3.95 | 38.54 |
| 9 | Crude fibre | 25.31 | 20.90 - 22.1 | 8.40 | | 10.80 | 10.40 | 92.69 | 5.53 | 21.85 |

was accounted for by both the genotypic and phenotypic variance for all the characters. There was a close correspondence between the phenotypic and genotypic variances, with only a minor difference between the two and this indicated that the characters were stable yet influenced by the environment a little.

The phenotypic and genotypic coefficient of variability were high for as many as five characters namely panicle length, number of tillers per plant, leaf width, stem thickness and leaf length and as such there is enough scope for improvement of these five characters through selection or an appropriate breeding method. The existence of such high genetic variation in napier grass has been reported earlier by Amirtha Devarathinam and Stephen Dorairaj (1992), Suthamathi and Dorairaj (1994) and in cumbu - napier hybrids by Fazlullah Khan *et al.* (1994). All the characters had moderate to high heritability values ranging from 80.15 for plant height to 98.14 for panicle length. The low variation between the values of genotypic and phenotypic variances for the different characters was also reflected in their high heritability values. Sukanya (1995) has also reported high broad sense heritability for most of the characters in napier grass. Leaf length and leaf width had moderate and high heritable values respectively. Mohan and Dua (1984) reported that with respect to genetic gain for green forage yield, dry matter and crude protein content, leaf traits (number, length and width) should be used in selecting genotypes with good harvest performance.

Genetic advance is a measure of genetic gain that can be expected in the process of selection. Panicle length, number of tillers, and leaf width recorded higher values of genetic advance as percentage of mean. High heritability combined with high genetic advance as per cent of mean observed for panicle length, number of tillers, leaf width and stem thickness suggest that these characters are under the control of additive type of gene action and hence these characters must be given more importance in selection. High heritability and moderate genetic advance as per cent of mean was observed for leaf length and crude protein content. Moderate heritability and moderate genetic advance as per cent of mean was observed for plant height and green fodder yield.

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