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Genetic Variability for Reproductive Characters in Guinea Grass (*Panicum maximum* Jacq.)

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ABSTRACT

A field experiment was carried out in Guinea grass (Panicum maximum Jacq.) with 37 genotypes including two check varieties, to study genetic variability for green fodder yield and its related characters. The observations were recorded on individual plant basis for five randomly selected plants of each genotype for each replication for plant height, number of tillers per hill, number of leaves per hill, leaf stem ratio, leaf area index, length of internode, leaf length, leaf breadth, days to flowering, length of panicle, number of panicles per hill, weight of seeds per hill, green fodder yield, dry fodder yield, crude protein content, crude fibre and gibberlic acid content. The results revealed that the genotypes were significantly different for all the 17 characters, indicating sufficient variability in the experimental material. The characters green fodder yield, leaf stem ratio, weight of seeds per hill, dry fodder yield and gibberlic acid content showed high GCV and PCV. High estimates of heritability along with high genetic advance (% of mean) were observed for number of tillers per hill, leaf stem ratio, weight of seeds per hill, crude protein content, crude fibre and gibberlic acid content. Therefore, selection for these characters will be more effective.

Key words: *Guinea grass, Heritability, Genetic advance, Genetic divergence, Panicum maximum*

INTRODUCTION

Guinea grass (*Panicum maximum*) is a tall vigorous perennial grass with stem height up to 3.5 m, high yielding, fast growing, nutritious, drought tolerant with wide variation in growth habit. As a perennial crop, it is suitable for cultivation in humid, tropical and subtropical areas with more than 900 mm of rainfall on a wide range of soils. The deep, dense and fibrous root system and hardy nature allows guinea grass to survive long drought periods; but it performs best on well drained soils of good fertility in high rainfall regions[12]. It is generally recognized as one of the best forage grasses of the tropics with good yield potential and produces good quality fodder when properly managed[22]. It is much valued for its productivity, palatability and good persistence[13].

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It responds well to cutting and grazing management and is fairly pest-tolerant[8]. Guinea grass has profuse thin tillers, quick regeneration and high leaf stem ratio[22]. It has high digestibility, crude protein and minerals. Crude protein was found to vary by 4 to 14 % of dry matter[5,11]. In vitro dry matter digestibility of the complete culm at the full head stage ranged from 41 to 72 % with most ecotypes having IVDMD values more than 60 %[3]. It tolerates shade and can be grown under tree plantations.

MATERIAL AND METHODS

The experimental material consisted of 37 accessions of Guinea grass (*Panicum maximum* Jacq.), obtained from various sources and maintained under AICRP (Forage) 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 were recorded on single plant basis, from five plants of each entry randomly selected. Average of these values was taken with respect to all biometrical characters. Statistical methods suggested by Burton[4] for variability, Lush for heritability and Johnson *et al*.[14] for genetic advance were adopted to find out the respective estimates.

RESULTS AND DISCUSSION

Analysis of variance revealed highly significant differences among accessions for all the characters under investigation thereby indicating the presence of high genetic variability in the experimental material (Table 1). The general mean value for each trait and its range among the genotypes and estimates of genetic parameters like phenotypic and genotypic coefficient of variation, heritability and genetic advance are presented in Table 2. The estimates of phenotypic coefficient of variation (PCV) were higher than the estimates of genotypic coefficient of variation (GCV) for all the traits under study indicating the environmental influence over the traits. High PCV and GCV were observed for green fodder yield (31.47, 22.43), leaf stem ratio (25.47, 20.48), weight of seeds per hill (23.72, 20.18), dry fodder yield (28.48, 22.06) and gibberlic acid content (25.36, 25.36) respectively. High magnitude of PCV and GCV indicated the presence of wide genetic variability for these traits and hence chances for improvement of these characters were fairly high. High significant variability was reported for leaf stem ratio by Ghazy *et al.*[9] leaf stem ratio and green fodder yield by Shanmuganathan *et al.*[21] and for dry matter yield by Nagar *et al.*[18] grain yield and green fodder yield by Dhedhi *et al*.[7] dry matter yield, leaf stem ratio, green fodder yield and number of tillers per meter row length by Nagendra and Shekhawat[19]. The high and moderate estimates of PCV and GCV were observed for leaf area index (25.98, 16.88), number of leaves per hill (25.50, 16.91), number of tillers per hill (20.58, 16.13) and number of panicles per hill (20.19, 15.03). Moderate PCV and GCV were observed for crude protein content (12.83, 12.74) and crude fibre content (12.54, 11.59). The moderate and low estimates of PCV and GCV were observed for length of panicle (11.15, 9.63) and days to flower (10.40, 8.43) respectively. Selection will be effective based on the heritable nature of these traits. Low PCV and GCV were observed for leaf length (8.73, 6.07), plant height (7.23, 4.39), leaf breadth (6.52, 3.68) and length of internode (5.81, 0.00) which are highly influenced by the environment and hence selection would be ineffective. This indicates that the breeders should go for high variability for these traits to make improvement. Similar results were reported by Vidyadhar *et al.*[24] for grain yield, tiller number, fodder yield and number of leaves; Ramakrishnan *et al*.[20] for number of tillers per plant and number of leaves per plant, crude protein content, Govindaraj *et al.*[10] number of productive tillers, plant height and day to 50 % flowering Dhedhi *et al*.[7] for days to 50 per cent flowering and plant height; Flag leaf length, days to 50 % flowering, protein content, plant height, flag leaf length, flag leaf width, days to 50% flowering by Kavya *et al*.[15] , Kour and Pradhan[16] for leaf width. High heritability coupled with high genetic advance was observed for numbers tillers per hill

(61.46, 26.06), leaf stem ratio (64.64, 33.92), weight of seeds per hill (72.39, 35.38), crude protein content (98.60, 26.07), crude fibre content (85.36, 22.06) and GA (99.91, 52.23). High heritability coupled with moderate genetic advance as per cent of mean was observed for days to flowering (65.76, 14.09) and length of panicle (74.59, 17.13). High heritability may be due to additive gene effects hence, these traits are likely to respond to direct selection. It is in accordance with the findings of Dhedhi *et al.*[7], Bhagirath *et al*.[2] for dry fodder yield, green fodder yield and days to 50 per cent flowering. Moderate heritability coupled with high genetic advance as per cent of mean was recorded for leaf area index (42.23, 22.60), number of leaves per hill (43.98, 23.10), number of panicles per hill (55.40, 23.05), green fodder yield (50.83, 32.95) and dry fodder yield (59.97, 35.19). Moderate heritability coupled with low genetic advance as per cent of mean was recorded for plant height (36.83, 5.19) leaf length (48.29, 8.69) and leaf breadth (31.87, 4.28). This character is affected by environment and is controlled by non-additive gene action. This character will have poor response for selection. Low heritability coupled with low genetic advance as per cent of mean was recorded for length of internode. These results are in conformity with the findings of Deepalakshmi and Ganesamurthy[6] for leaf breadth, Aditya *et al*.[1] for number of panicles per plant, Warkad *et al.*[25] for number leaves per plant, Vidyadhar *et al*.[24] for leaf length and leaf width.

Table 1: Analysis of variance of 37 genotypes for 17 characters

Source of variation	df	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
MSS Treatment	36	22.33**	152.14*	43.93**	0.027*	2.14**	1.94	34.60**	51.82**	1716.03**
MSS Replications	1	0.85	240.07	90.42	0.020	4.43	0.87	34.64	38.12	117.33
MSS Error	36	4.61	70.24	15.31	0.014	0.87	2.12	5.03	12.36	667.72

Source of variation	df	No. of panicles per hill	Green fodder yield (t/ha)	Leaf-stem ratio	Wt. of seeds per hill (g)	Dry fodder yield (t/ha)	Crude protein content (%)	Crude fibre content (%)	Gibberlic acid content (mg/g)
MSS Treatment	36	23.98**	658.83**	0.058**	7.27**	38.04**	4.01**	25.13**	502.19**
MSS Replications	1	69.67	2634.85	0.006	5.03	3.80	0.114	6.53	0.451
MSS Error	36	6.88	214.77	0.012	1.16	9.51	0.0283	1.98	0.235

***Significant at 5 % level** ****Significant at 1 % level**

Table 2: Mean, Range and estimates of genetic parameters for seventeen characters in Guinea grass

Sr. No.	Characters	General Mean	Range	PV	GV	P.C.V	G.C.V	h^2 (%)	GA 5%	GA as% of mean
1	Days to flowering	35.27	29.9 - 43.30	13.47	8.86	10.40	8.43	65.76	4.97	14.09
2	Plant height (cm)	145.68	122.15 -163.75	111.19	14.09	7.23	4.39	36.83	8.00	5.49
3	Leaf length (cm)	62.29	54.8 - 75.30	29.62	14.30	8.73	6.07	48.29	5.41	8.69
4	Leaf breadth (cm)	2.22	2.02 - 2.53	0.02	0.006	6.52	3.68	31.87	0.09	4.28
5	Leaf area index	4.73	3.25 - 7.42	1.51	0.63	25.98	16.88	42.23	1.06	22.60
6	Length of internode (cm)	24.61	22.80 - 26.98	2.049	-0.075	5.817	0.000	-0.036	-0.108	-0.440
7	Length of panicle (cm)	39.92	33.75 - 50.70	19.81	14.78	11.15	9.63	74.59	6.84	17.13
8	No. of tillers per hill	27.52	17.80 - 38.85	32.09	19.72	20.58	16.13	61.46	7.17	26.06
9	No. leaves per hill	135.35	88.80 – 219.00	1191.87	524.15	25.50	16.91	43.98	31.27	23.10
10	No. of panicles per hill	19.45	13.20 - 27.75	15.43	8.54	20.19	15.03	55.40	4.48	23.05
11	Green fodder yield (t/ha)	66.40	37.49 - 125.62	436.80	222.03	31.47	22.43	50.83	21.88	32.95
12	Leaf-stem ratio	0.74	0.52 - 1.46	0.03	0.02	25.47	20.48	64.64	0.25	33.92
13	Wt. of seeds per hill (g)	8.66	4.70 - 12.80	4.22	3.05	23.72	20.18	72.39	3.06	35.38
14	Dry fodder yield (t/ha)	17.12	10.03 - 30.23	23.78	14.26	28.48	22.06	59.97	6.02	35.19
15	Crude protein content (%)	11.07	7.90- 13.40	2.02	1.99	12.83	12.74	98.60	2.88	26.07
16	Crude fibre content (%)	29.35	22.00 - 35.50	13.56	11.57	12.54	11.59	85.36	6.47	22.06
17	Gibberlic acid content (mg/g)	62.44	35.15 - 99.75	251.21	250.97	25.38	25.36	99.91	32.61	52.23

CONCLUSION

In the present study genetic analysis showed that high heritability estimates along with genetic advance were more useful than heritability estimates alone in predicting response to selection. High heritability along with high genetic advance (% of mean) was observed for number of tillers per hill, leaf-stem ratio, weight of seeds per hill, crude protein content, crude fibre and gibberlic acid content and hence selection will be more effective for these characters. Low heritability and low genetic advance (% of mean) was observed for length of internode. Moderate heritability coupled with low genetic advance as per cent of mean was recorded for plant height, leaf length and leaf breadth, response of these characters to selection will be poor and unrewarding.

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