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EVALUATION OF EXOTIC ACCESSIONS OF GUINEA GRASS (*Panicum maximum* JACQ.)

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Thirty six exotic accessions of *Panicum maximum* from ILRI, Ethiopia were evaluated for nineteen characters including several metric, qualitative parameters and were compared with the already existing variability in the indigenous collections. The introduced germplasm has appreciable variation for characters such as, plant height, leaf and flower characters as well as for crude protein content. The promising accessions consisting of desirable characteristics were identified and their potential to guinea grass improvement is discussed.

Key words : Guinea grass, *Panicum maximum*, evaluation

Guinea grass (*Panicum maximum* Jacq.) is an important fodder grass speceis throughout the tropics (Burton *et al.*, 1973). It is indigenous to Africa and was introduced in India in the last decade of 18th century and at present occupies approximately 0.1 million hectare area, under cultivation. The grass normally reproduces through apomixis and has very good yield potential (70-100 tonnes/ha green fodder) and produces high quality forage under optimum management (Hazra 1995).

In a programme to enrich the existing germplasm collections of *P. maximum* at Indian Grassland and Fodder Research Institute (IGFRI) Jhansi, introductions were made from International Livestock Research Institute (ILRI), Ethiopia. To assess the extent of diversity and to identify promising genetic stocks for crop improvement, all accessions were evaluated for morphological and quality characters.

MATERIALS AND METHODS

Thirty six accessions of *P. maximum* were grown in Randomized Block Design in three replications during 1997-1998. Each accession was sown in a single row of 3 m length with 0.75 m spacing between rows and between plants. Recommended agronomic practices were followed in raising the crop. Observations were recorded on three plants per replication of each accession after 100 days of transplantation (in post rainy season) for 18 characters including nine metric observations. The data were recorded for plant height, growth and tillering habit, days to 50% flowering, leaf length, leaf width, leaf and leaf sheath hairiness, panicle length, flowering stalk length, flower colour, lemma hairiness, flower density, maturity and summer tolerance. The representative samples of whole plant were collected, processed and analysed in duplicate for dry matter content, crude protein (AOAC, 1984) and neutral detergent fibre content (Goering and Van Soest, 1970). Accessions were grouped on the basis of morphological and quality attributes and the entries possessing desirable agronomical traits and novel variations were identified.

RESULTS AND DISCUSSION

The observations recorded on 36 exotic lines showed high degree of variation for various

qualitative and metric characters such as plant height, branching pattern, leaf characters, flowering time, floral characteristics and crude protein content (Table 1).

Table 1. Variation in metric characters exhibited by exotic lines of *Panicum maximum*

S. No	Character	Range	Mean ± SD
1	Plant height (cm)	81.0-169.0	128.50±24.44
2	Leaf length (cm)	19.0-88.0	38.2±14.1
3	Leaf width (cm)	1.0-2.9	1.91±0.53
4	Panicle length (cm)	24.0-80.0	41.54±12.98
5	Flowering stalk length (cm)	47.0-101.0	72.93±14.24
6	Days to 50% flowering	115-147	136.11±9.41
7	Dry matter content (%)	28.31-47.02	36.88±5.73
8	Crude protein content (%)	3.50-8.41	6.20± 1.27
9	Neutral detergent fibre (%)	70.24-78.90	75.06±2.39

Plant height ranged between 81 cm (accession EC 400548) to 169 cm (EC 400561) with an average of 128.50 cm. Five accesions (EC 400536, EC 400546, EC 400561, EC 400562, and EC 400565) were grouped as tall (> 160 cm) whereas three accessions (EC 400545, EC 400570 and EC 400576) were grouped as dwarf types (< 100 cm). The average plant height of these lines was quite less as compared to the indigenous collections wherein most of the accessions attained the height between 157-217 cm (Malaviya 1996). Average leaf blade length was 38.2 cm and their width ranged between 1.0 cm (EC 400577) to 2.9cm (EC 400535). Accession EC 400561 showed longest panicle (80 cm) as well as flowering stalk (101 cm).

Considerable variation was observed for qualitative characters such as leaf and leaf sheath hairiness and flower colour and hairiness (Fig. 1). None of the accessions possessed hairiness on lemma whereas a total of 14 accessions were found to be non-hairy both for leaf and lemma surface. Three accessions possessed dense hair both on leaf and leaf sheath. Rest of the accessions showed different combinations of presence/absence and density of hairiness on leaf and leaf sheath. These combinations were believed to be the result of natural hybridization. Some of the novel combinations of flower and leaf characters previously not present in the indigenous collections (IGFRI, 1998; Malaviya, 1996) were introduced through exotic lines and are shown in Table 2.

Table 2. Combination of flower and leaf characters introduced through exotic lines

Character				No. of accessions	Accession nos
Fl cl*	Fl ts	LS	LSS		
ppg	gl	lh	dh	3	EC400541, EC400547, EC400577
ggg	gl	gl	gl	2	EC400555, EC400578A
pgg	gl	mh	gl	1	EC400534
pgg	gl	dh	dh	1	EC400578

*flower colour represented by colour of lemma 1, lemma 2 and ligule respectively Fl cl-flower colour, Fl tx-flower texture, LS-leaf surface, LSS-leaf sheath surface, p-purple, g-green, lh- less hair, mh-medium hairy, dh-dense hairy, gl-glaborous

Most of the accessions flowered within 115 to 130 days of sowing. However, two accessions EC 400552 and EC 400563 were identified to be late in flowering (> 145 days). Eleven accessions had soft leaves and of these, three accessions (EC 400578, EC 400560 and EC 400540) possessed highly soft leaves. Plants belonging to EC 400536 and EC 400578 had shown within line variation for some characters and represented by subscript 'A' wherever necessary. If the probability of mechanical mixture is ruled out, the mother plant of these seeds have a likelihood of reproduction by facultative apomixis.

Based on overall plant morphology, the accessions were grouped into six discrete categories (Table 3). Accessions possessing one or more special/rare characters such as narrow stem and leaves, high seed production, high seed retention,

Table 3. Morphological grouping of *P.maximum* lines

Group	Characteristics	Total accessions	Acc.nos. of entries
I	Robust growth, late flowering, coarse broad leaves	4	EC400539, EC400546, EC400549, EC400570
II	Vigorous growth, late flowering, soft broad leaves	15	EC400532, EC400534, EC400535, EC400536, EC400536, EC400543, EC400544, EC400548, EC400552, EC400561, EC400563, EC400566, EC400567, EC400571, EC400578
III	Vigorous growth, early flowering, soft broad leaves	2	EC400555, EC400565
IV	Medium growth, medium softer leaves, early flowering	4	EC400538, EC400558, EC400560, EC400562
V	Medium growth, medium softer leaves, late flowering	2	EC400547, EC400553
VI	Accessions possessing special characteristics*	11	EC400540, EC400541, EC400550, EC400551, EC400557, EC400564, EC400569, EC400572, EC400576, EC400577, EC400578

*See text for details

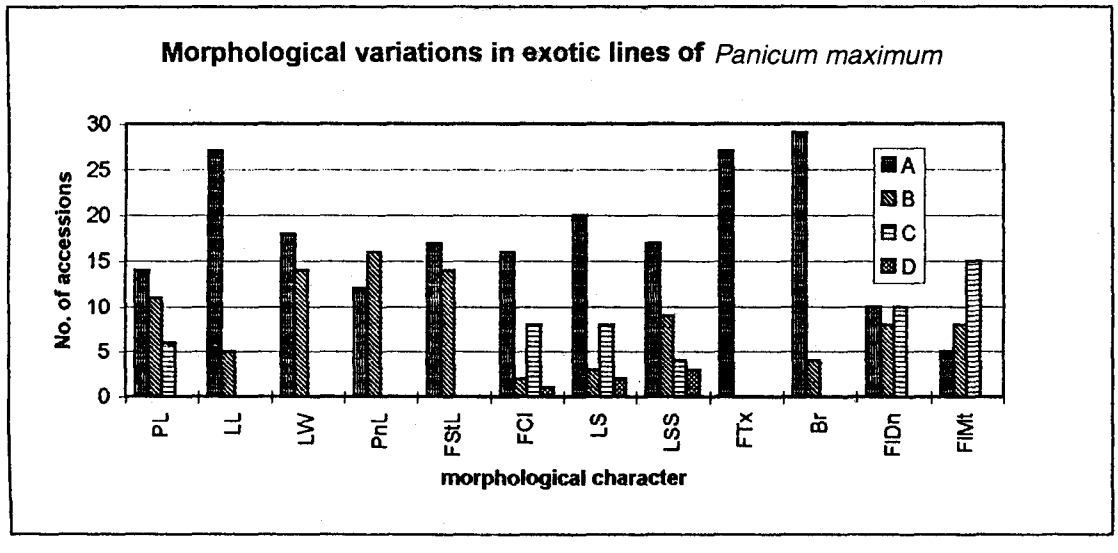

Fig. 1. Plant height (cm) [PL]: A:75-120, N:121-160, C:161-200; Leaf length (cm) [LL]: A:18-50, B:51-88; Leaf width (cm) [LW]: A:1.0-1.9, B: 2.0-2.9; Panicle length (cm) [PnL]: A:22-40, B:41-58; Flowering stalk length (cm) [FStL]: A:55-74, B:75-101; Flower colour [FCl] (lemma1+lemma2+ligule, p=purple, g=green): A: ppg, B: ggg, C: pgg, D: ppp; Leaf surface [LS] and Leaf sheath surface [LSS]: A: glaborous, B: dense hairy, C: scanty hairy, D: medium hairy; Flower texture [FTx]: A: glaborous, B: hairy; Branching [Br]: A: 4-6 branches, B: profuse branching; Flower density [FlDn]: A: less, B: medium, C: high; Flower maturity [FlMt]: A. early, B: medium, C: late.

high tillering, very small internodal length, etc. were categorised under group VI. The tallest accession EC400561 had also shown highly vigorous growth, longest leaf, panicle and flowering stalk length.

The accessions possessing traits of economic importance have been identified and represented in Table 4. Some of the accessions which possessed highly desirable characters such as soft leaves, lateness in flowering and high seed retention are being evaluated in detail to explore their potential.

Table 4. Promising accessions of *P.maximum* for specific traits

Trait	Accessions
Highly soft leaves	EC400560, EC400578, EC400540
High leaf-stem ratio	EC400555, EC400561
Robust growth	EC400539, EC400546, EC400549, EC400570
Higher tillering and Seed production	EC400550, EC400541, EC400569, EC400572, EC400577
Better seed retention	EC400577, EC400565, EC400567, EC400569, EC400541
High protein	AEC400560, EC400539, EC400540
High dry matter content	EC400550, EC400558, EC400560
Summer tolerance	EC400553
Late flowering	EC400552, EC400563
Thicker stem	EC400536, EC400546
Prostrate growth habit	EC400541, EC400551, EC400572, EC400577
Profused branching	EC400535, EC400536, EC400547, EC400555

The availability of variability and novel combinations reported in exotic lines could potentially be used to generate more variation through hybridization programme and for blending of the desirable characters in the favourable genotype to be utilised in *P. maximum* improvement programme.

REFERENCES

A.O.A.C. 1984. Official Methods of Analysis. 14th edn. Association of Official Analytical Chemists, Washington DC.

Burton G.W., J.C. Millot and W.G. Monson. 1973. Breeding procedures for *Panicum maximum* Jacq. Suggested by plant variability and mode of reproduction. *Crop Sci.* 13: 717- 720.

Goering H.K. and P.J. Van Soest. 1970. Forage fibre analysis ARS U.S. Deptt. Agric. Handbook No. 379, Washington DC.

Hazra C.R. 1995. Advances in Forage Production Technology. C.R. Hazra (Ed.). Project coordinator (Forage Crops), Indian Grassland & Fodder Research Institute, Jhansi, India.

IGFRI. 1998. Annual Report - Indian Grassland and Fodder Research Institute, Jhansi, India, 44p.

Malaviya D.R. 1996. Distribution of morphological diversity among germplasm lines of *Panicum maximum* Jacq. *Indian J. Pl. Genet. Resources* 9: 193-196.