PRELIMINARY EVALUATION OF INTRODUCED AND LOCAL LINES OF PEARL MILLET UNDER NORTH SINAI CONDITIONS

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ABSTRACT

Field trials were conducted during 1994 and 1995 seasons on calcareous soil to evaluate thirty introduced and local lines of forage pearl millet (*Pennisetum americanum*). The evaluation included growth characteristics, forage yield, chemical composition and ion content. Present results of both seasons indicate that the thirty lines varied significantly in their growth, forage yield, chemical composition and ion content, organic and inorganic. The top productivity of dry yield and its components was from the ICMP-155, while the lowest was from an introduced line from Ghana. Also, the line ICMP-155 gave the highest values of C.P., P^{+++}, K^{+}, Ca^{++} and Fe^{++} and improvment in lowering Ca^{++}/P^{+++} ratio and the lowest value of C.F. Results also suggested that ICMP-155 can be grown under North Sinai conditions as a new forage crop in summer season.

KEYWORDS

Pennisetum americanum, pearl millet, selection.

INTRODUCTION

Pearl millet, *Pennisetum americanum* (L.) Leeke, is primarily grown as a forage crop in Egypt. It is also considered to be one of the most important forage crops in summer season. In El-Arish, North Sinai, new introduced and local lines were evaluated as an adaptation trial for possible use to improve the forage yield of pearl millet to meet the increasing demand of livestock feed in the summer season. Pearl millet is more efficient in water utilization and has higher heat and salt-tolerance than corn or sorghum. Therefore, this crop as a whole shows enormous variation in growth and development such as shape and size of the spikes, tillers number, leaf number and size, plant height, maturity, stem thickness, amount of bristle development, glume color and several other characters (Maiti and Bisen, 1978). Pearl millet collections have a sufficient genetic variability for a wide range of maturities and dry conditions. Thus, it is considered the broad adaptation crop to environmental stress. Many investigators have recognized superiority of pearl millet over wheat, corn and sorghum under dry, hot and saline conditions in semi-arid land (Ferraris, 1973). The collection and evaluation of pearl millet germplasm is suggested by Appa Rao *et al*., 1982; Bidinger *et al.*, 1994. Makeri and Ugherugh (1992) evaluated twenty cultivars of pearl millet '*Pennisetum glaucum'* for their growth, forage yield and mineral content. They found that the cultivars were significantly different in DM yield and K content in each cutting. Differences in CP and CF contents were significant only between cuttings. Variation in CP and CF contents ranged from 14.1 to 20.3% and from 28 to 30%, respectively. Our objective of this study was to select some new introduced and local lines of pearl millet to be adapted to North Sinai conditions, and to improve its performance for growth and production in calcareous soil.

MATERIALS AND METHODS

Thirty pearl millet lines were grown as a forage in calcareous soil at the El-Arish Farm of the Faculty of Environmental Agricultural Sciences, North Sinai Governorate for two successive summer seasons in 1994 and 1995. The experimental design was a randomized complete block with four replications and introduced and local lines were randomized within the block. Drip irrigation system was used for irrigation, and the distance between lines (rows) 1 m and dripper were 50 cm apart. Plot size was three lines of 6 m long with 2 m row width. Planting date was on April 1 and May 5 in the first and second seasons, respectively. Plants were thinned to individual plants after three weeks of sowing The experiment was irrigated as needed throughout the growing season. The normal cultural practices of growing pearl millet were used for both years. Three cuts were taken at 45, 85 and 120 days after sowing. Data were recorded on the following parameters during both seasons: plant height, number of tillers/plant, stem diameter, number of leaves/stem and dry weight/ plant. Crude protein (CP), fats (EE), crude fibers (CF), ash and minerals analysis (macro and micronutrient) were determined in dry matter (stem and leaves) of the second season according to AOAC (1980). Analysis of variance was done according to Snedocor and Cochran (1980). The mean values for the lines were compared at the 0.05 level of significance by Duncanís multiple range test of means separation (Duncan, 1955).

RESULTS AND DISCUSSION

The results in Table (1) showed that there were significant differences among lines for all growth and development characters in both seasons. Generally, the mean values of plant height were highly significant among the studied lines at the three cuts over seasons. The highest plant height was found in Nigerian introduced line (No. 287057) with 103.02 cm over two seasons and the lowest plant height was found in the Ghana introduced line with mean value of 87.44. The number of tillers/plant had highly significant differences among the tested lines for cuts, years and years x cuts. The line ICMP-155 gave the highest tillers/plant, whereas Ghana introduced line gave the lowest number of tillers/plant. The diameter of stem showed that cuts, lines and lines x cuts interactions produced highly significant differences among lines for this character, while years and their interaction did not show any differences for stem diameters among lines under study. However, ICMP-155 lines showed the highest stem diameter, whereas the lowest stem diameter was obtained in Ghana introduced lines. The number of leaves/plant showed highly significant differences among the thirty introduced and local lines. The highest mean value was found in IMCP-155 while the lowest mean value was obtained with Ghana line. Dry weight/plant varied significantly among the thirty introduced and local lines. The line ICMP-155 obtained the highest dry weight/plant and the lowest was in the Ghana line. (See Table 1.) In general, improved forage yield depended on the growth characters such as plant height, number of tillers/plant, stem diameter, number of leaves, that were an effective procedure for increasing total forage production. The trends of the results were similar to previous studies of Maiti and Bisen (1978) and Makeri and Upherugh (1992). The results indicated that the collection of germplasm are important for growth characters which depend on effectively identifying of superiority genotypes. These results agree with those of Appa Rao *et al.* (1982) and Bidinger *et al.* (1994). The results also suggested that the collection of thirty lines would have a sufficient genetic variability and a broad adaptation in an arid environment. These results were similar to the findings of Ferraris (1973). It is clear from the data in Table (2) that the thirty introduced and local lines varied for organic and inorganic constituents. The introduced line ICMP-155 showed the highest crude protein and ash percentages with mean values of 20.94, and 11.99, respectively, whereas the lowest mean values of crude protein and

ash percentages were obtained from the introduced line from Ghana with means value of 10.25 and 6.72, respectively. Macronutrient and micronutrient contents deficiencies cause serious disturbances in forage productivity. However, the thirty lines were varied in ion contents. An introduced line ICMP-155 obtained the highest contents of P^{+++}, K^{+}, Ca^{++} and Fe^{++} with mean values 0.30, 2.50, 0.28% and 585.5 ppm, respectively whereas, the lowest ion contents were found in an introduced line from Ghana with mean values of 0.12, 1.28, 0.23 and 110 ppm. The variation of forage quality is dependent on organic and inorganic constituents in the plant tissue. Improvement in the P^{+++} content is necessary in order to obtaine the low Ca^{++}/P^{+++} ratio which is a desirable characteristic in forage for animal consumption. Growth characters such as number of tillers/plant, plant height, leaves number/stem were related to organic and inorganic constituents. These results were similar to previous studies by Khadr *et al.* (1988); Makeri and Ugerugh (1992) and Belal *et al.* (1993).

Comparing the various chemical constituents among the thirty lines in these studies (Table 2), it is noted that CP and CF were ranged from 10.25% to 20.94% and from 24.53% to 35.60%, respectively. These results agree with Makeri and Ugerugh (1992).

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Table 1
Mean values of various growth characters for each of the thirty pearl millet lines over 1994 and 1995 seasons.

No.	Name	Origin	Plant height (CM)	No. of tillers	Stem diameter (mm)	No. of leaves/stem	Dry weight/plant (gm)
1	*P. americanum* - 286869	Nigeria	94.99abcdefg	4.27abcd	1.48bcde	7.27abcd	77.54ghij
2	*P. americanum* - 248720	South Africa	99.10abcd	4.14bcd	1.52abcd	7.50abcd	93.79cdefgh
3	*P. americanum* - 263541	South Africa	98.55abcd	4.27abcd	1.54abcd	7.12abcde	89.88cdefgh
4	*P. americanum* - 452269	Turkey	98.55abcd	4.43abcd	1.35de	6.90abcde	108.08abcdef
5	*P. americanum* - 331666	Ethiopia	95.52abcdefg	4.57abc	1.46bcde	6.62abcdefg	106.63abcde
6	*P. americanum* - 452268	Turkey	91.70cdefg	4.31abcd	1.51abcd	7.18abcd	105.17abcdef
7	*P. americanum* - 402282	USA	93.62abcdefg	4.61abc	1.46bcde	7.27abcd	112.88abc
8	*P. americanum* - 287057	Nigeria	103.02a	4.63abc	1.40bcde	7.19abcd	118.68ab
9	*P. americanum* - 186338	Australia	92.05cdefg	4.55abc	1.53abcd	7.03abcde	84.75efghij
10	*P. americanum* - 164421	India	98.17abcd	4.67abc	1.58abc	7.81ab	93.83cdefghi
11	*P. americanum* - 337492	Brazil	98.38abcd	4.31abcd	1.48bcde	7.31abcd	82.17fghij
12	*P. americanum* - 243842	Senegal	98.71abcd	4.36abcd	1.41bcde	6.54bcdefg	89.29cdefghij
13	*P. americanum* - 40253	USA	90.38defg	4.66abc	1.59ab	6.51bcdefg	95.71bcdefgh
14	---------- -----	Zimbabwe	96.65abcdefg	5.95abc	1.56abcd	5.84efg	97.17bcdefgh
15	ICMP - 88130	ICRISAT*	94.73abcdefg	4.72abc	1.39bcde	6.18defg	78.79ghij
16	ICMP - 87101	ICRISAT	95.26abcdefg	6.45ab	1.44bcde	6.58abcdefg	87.25defghij
17	ICMP - 88904	ICRISAT	97.05abcdef	4.49abc	1.44bcde	6.71abcdefg	81.21fghij
18	ICMP - 7703	ICRISAT	101.88ab	4.76abc	1.57abcd	6.92abcde	78.17fghij
19	ICMP - 88101	ICRISAT	98.44abcd	5.36abc	1.53abcd	6.38cdefg	87.25defghij
20	ICMP - 87101	ICRISAT	99.95abcd	5.00abc	1.36cdb	6.80abcde	92.08cdefghij
21	ICMP - 155	ICRISAT	99.16abcd	6.50a	1.70a	7.87a	124.75a
22	WCC - 75	ICRISAT	98.83abcd	4.98abc	1.53abcd	6.68abcdef	101.79abcdefg
23	WCC - 8202	ICRISAT	100.78abc	5.25abc	1.56cde	6.63abcdefg	109.96abcd
24	ICMV - 88908	ICRISAT	97.45abcde	4.75abc	1.52abcd	6.60abcdefg	113.50abcd
25	Select. Early Flowering	Egypt	93.10bcdefg	4.63abc	1.52abcd	6.28cdefg	99.42bcdefg
26	Niger population	Niger	93.63abcdefg	4.22abcd	1.51abcd	5.44fg	81.92fghij
27	Introduc. from Zimbabwe	Zimbabwe	88.80efg	4.16bcd	1.62abcd	6.15fg	87.08defghij
28	Introduc. from Ghana	Ghana	87.44g	3.86d	1.28e	5.39g	65.92j
29	Brown medium tall	USA	87.70fg	4.04cd	1.36cde	6.67abcde	68.79ij
30	Local variety	Egypt	90.34defg	4.20abcd	1.41bcde	6.41cdefg	75.79hij

Means with the same letters are not significantly different at 5% of probability level.
* International Crops Research Institute for the Semi-Arid Tropics.

Table 2
The range and an average of the chemical compositions of forage pearl millet (leaves and stems) grown at El-Arish, North Sinai.

No.	Parameters	Range	Average
1	Crude protein (%)	10.25 - 20.94	15.59
2	Crude fiber (%)	24.53 - 35.60	28.72
3	Ether Extract (%)	0.83 - 2.38	1.27
4	Ash (%)	6.72 - 11.99	9.48
5	P (%)	0.09 - 0.30	0.20
6	K (%)	1.28 - 2.50	1.83
7	Ca (%)	0.23 - 0.75	0.38
8	Mg (%)	0.23 - 0.55	0.38
9	Fe (ppm)	110.00 - 585.00	302.17
10	Zn (ppm)	50.00 - 107.00	77.73
11	Mn (ppm)	60.00 - 152.50	99.87
12	Cu (ppm)	22.50 - 62.50	36.67