BREEDING TO INCREASE PRODUCTIVITY AND GRAIN YIELD IN PEARL MILLET

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ABSTRACT

Eleven new test entries of pearl millet of diverse genetic background were evaluated at three test locations against eight of their recurrent parents.

Six improved varieties, four of which were developed from the Namibian Germplasm. Accessions were added to make a 5 x 5 lattice design.

This field experiment was conducted during the main season of 1995\96 to find out which of the new test entries will be most suitable and adopted to our growing conditions.

The trial was conducted at three different ecological test sites in three political regions namely Mashare Agricultural Development Institute, Okashana Research and Training Centre and Ogongo Agricultural College.

NPMV 94001, NPMV 94002, NPMV 94003, NPMV 94004, NPMV 94005 and NPMV 95001 appeared among the top ten entries at all test locations.

NPMV 94004 and NPMV 95001 appeared to have some yield stability across all test environments (see Tables 1-3).

INTRODUCTION

Pearl Millet (*Pennisetum glaucum* (L) Br.) is the sixth most important cereal crop in the world.

It is the number one crop in much of rural Namibia. To provide more food and to increase household food security increased pearl millet yields are a necessity. Such increases can be attained through the development of high yielding cultivars that are adopted, suitable and accepted by the end-users. By providing the best field conditions and natural methods which maximize grain production, one can also increase grain yield. Burton (1951), Shanker et al (1963), Gupta and Atwal (1966) reported that plant traits such as maturity, tillering ability, height, panicle length, as well as panicle thickness have been found to affect yield in pearl millet.

Most of these traits are quantitatively controlled and thus are affected by environmental factors.

After studying a group of germplasm collection Gupta and Nanda (1971) found panicle weight, number of tillers, earliness, grain size and density to be important components of grain yield.

Early maturity is a desirable plant characteristic in crops that are used for grain production,because it helps the plant to escape drought. Planting early and using early maturing cultivars could reduce the losses in grain yield attributable to terminal droughts and other environmental factors. Increasing grain yield through recurrent selection is feasible due to Pearl millet's tremendous genetic variability (Burton and Powell, 1968, Rattunde et al.,1989). Attention must also be given to the yield stability of improved pearl millet populations due to the threats of severe moisture deficits (Bidinger et al., 1982)

The major objectives of the National Pearl millet Improvement Programme is therefore to increase grain yield and yield stability through development and testing of new cultivars. Genetic and breeding improvements are long term ways of improving grain yield.

MATERIALS AND METHODS

Eleven new test entries developed by the Pearl millet Improvement section of the Directorate of Research and Training through our Backcrossing programme,were evaluated against eight of the recurrent parents. Five Improved varieties plus a local control were added to constitute a 5x5 lattice. These varieties were tested at three different sites. The design was lattice with three replications. The plots consisted of four rows of four metres long each and 0.75 m apart. The two central rows were used for data collection.

Plant height (cm) and panicle length (cm) were measured from base of the plant to the tip of the panicle (head) and the base of the panicle (ear) to the tip of the ear (panicle). Days to 50% bloom was estimated as days from emergence to 50% anthesis. Data on grain yield per plot and head weight per plot (kg) were obtained by weighing bulked grains after threshing and bulked heads after drying from each plot. Yield were converted to yield ton/ha. For each plot harvested heads were counted. Threshing percentage was obtained as a ratio between grain weight and head weight. MSTATC package was used to analyse the experimental data. Data were separately analysed and presented.

RESULTS AND DISCUSSION

Results of this experiment showed that NPMV 95002 flowered earlier than all test entries tested at Okashana Research and Training Centre. This variety was 7.666 days earlier than Okashana -1 and 21.333 days earlier than Farmers' Local. At this test location NPMV 94004 was the highest yielding test entry to yield 1.006 tonnes per hectare (see Table 1, pg. 71).

At Ogongo NPMV 95001,NPMV 94004 and NPMV 94005 were the top three varieties. All outyield the controls. There is no significant difference between all the entries tested in days to 50% bloom (see Table 2, pg. 72).

At Mashare NPMV 94001,NPMV 94002 and NPMV 94004 were the best test varieties.

These varieties outyielded Okashana-1 and the yield difference were 1.407,1.187 and 0.814 ton/hectares respectively. The yield differences between these varieties and the farmers local were 1.866,1.646 and 1.273 tonnes per hectare respectively.

CONCLUSION.

NPMV 94001,NPMV 94002,NPMV 94003,NPMV 94004 and NPMV 95001 appeared among the top yielding test entries across location. NPMV 94004 and NPMV 95001 seemed to have some yield stability across all test environments (see Tables 1-3, pages 71, 72 and 73).

In pearl millet traits such as large seed, long panicles, tillering ability, pests and disease resistance and earliness favour high yield. Improvement of crops through breeding procedures is dependent upon the presence of genetic variability among plants within the species. Selection for high yield and stability of yield has resulted in improved resistance to specific environmental stress. Landraces are a good example of the effect of repeated long-term selection for stable production under stress conditions. Landraces are recognised as valuable genetic resource for important agronomic triats.

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TABLE 1: PERFORMANCE DATA OF NAMIBIA PEARL MILLET EVALUATION TRIAL 1995/96 SEASON CONDUCTED AT OKASHANA RESEARCH AND TRAINING CENTRE.

No	Variety Name	Bloom	PHT	EL	HC	THRESH%	Yield T/Ha
1.	BBC4F1(LRx Ok-1	55.333	146.667	27.000	45.000	70.667	1.055
2.	NPMV 94004	51.000	129.333	24.667	35.667	69.333	1.006
3.	SDMV 93032	49.667	117.333	17.333	52.667	68.667	0.800
4.	IP 17531	52.924	119.512	20.028	39.708	64.680	0.632
5.	NPMV 95001	53.000	122.000	23.000	26.333	61.333	0.594
6.	NPMV 94002	51.667	145.333	25.667	35.333	63.667	0.594
7.	NPMV 94005	54.667	131.667	23.333	28.000	56.667	0.583
8.	HHVBC	52.000	114.000	21.000	40.333	65.000	0.578
9.	SDMV 92038	54.667	143.333	33.333	25.000	57.000	0.567
10.	WGC	54.000	140.667	24.333	35.333	60.667	0.556
11.	NPMV 95002	44.667	148.000	27.333	23.667	58.333	0.500
12.	NPMV 94001	52.000	120.667	23.667	36.667	57.333	0.483
13.	NPMV 94007	57.000	153.333	26.000	23.333	56.333	0.461
14.	Maria Kaherero	56.667	124.667	23.000	30.667	65.667	0.458
15.	NC-90	56.000	147.333	29.333	27.000	60.667	0.450
16.	Okashana-1	52.333	111.333	17.333	20.667	66.667	0.394
17.	NPMV 94009	52.833	106.000	19.000	28.500	62.667	0.383
18.	SDMV 92034	53.000	132.667	28.000	18.333	58.667	0.353
19.	NPMV 94003	56.000	112.667	20.667	24.667	58.667	0.339
20.	SDMV 92036	59.333	116.667	23.000	19.333	59.667	0.333
21.	NPMV 94006	57.000	136.000	25.333	17.333	51.333	0.311
22.	BBC4F1(LRxWGC)	52.667	118.667	22.000	16.333	57.667	0.306
23.	NPMV 94008	61.667	124.333	19.000	17.000	53.333	0.222
24.	F.Local	66.000	130.667	27.667	10.333	57.667	0.144
25.	SDMV 92035	62.000	128.000	25.667	14.000	55.667	0.142
Mean		54.693	128.627	23.840	27.587	60.653	0.487
S.E±		0.692	2.411	0.647	1.841	0.927	0.041
C.V%		8.060	13.320	19.710	52.150	12.550	61.480
LSD(5%)		7.244	28.187	7.726	23.684	12.517	0.495

TABLE 2: PERFORMANCE DATA OF NAMIBIA PEARL MILLET EVALUATION TRIAL 1995/96 SEASON CONDUCTED AT OGONGO AGRIC. COLLEGE.

No	Variety Name	Bloom	PHT	EL	HC	THRESH	Yield T/Ha
1.	NPMV 95001	59.000	152.333	26.000	34.000	59.667	0.979
2.	NPMV 94004	58.667	146.000	24.333	37.333	59.333	0.935
3.	NPMV 94005	59.333	157.333	34.000	34.667	61.667	0.918
4.	SDMV 93032	58.667	135.000	21.333	35.333	61.667	0.855
5.	NPMV 94002	59.667	140.000	27.010	39.000	59.667	0.834
6.	Okashana-1	57.667	139.333	32.000	33.667	67.333	0.824
7.	W G C	59.600	148.800	23.695	32.163	53.808	0.822
8.	NPMV 94003	59.000	155.000	26.667	28.333	61.000	0.822
9.	NPMV 94001	59.000	145.667	28.667	36.667	59.00	0.759
10.	Maria Kaherero	59.000	157.000	34.333	31.000	57.667	0.731
11.	NPMV 94007	59.000	159.000	37.000	29.667	60.333	0.713
12.	NPMV 94008	59.667	151.000	32.667	32.000	51.333	0.690
13	BB4F1(LRxOk-1)	59.636	149.399	28.481	32.264	52.534	0.672
14	F.Local	61.333	151.667	31.000	26.667	56.667	0.655
15.	IP 17531	58.886	154.899	20.982	28.764	50.534	0.641
16.	NPMV 94006	62.000	145.000	30.000	23.333	61.333	0.631
17.	NPMV 94009	58.667	147.667	25.167	27.167	54.167	0.628
18.	NPMV 95002	61.333	139.000	29.000	25.333	54.333	0.624
19.	SDMV 92035	60.667	167.000	36.333	25.000	60.333	0.600
20.	SDMV 92034	60.333	164.667	36.333	22.333	61.000	0.587
21.	SDMV 92036	60.667	184.000	43.000	22.333	53.667	0.573
22.	HHVBC	59.000	162.000	31.667	23.000	54.333	0.543
23.	NC90	59.667	151.000	29.333	28.667	55.000	0.543
24.	BB4F1(LRxWGC)	60.000	149.667	30.333	27.000	53.667	0.497
25.	SDMV 92038	61.333	152.000	37.000	15.667	69.000	0.483
	Mean:	59.667	152.253	30.373	29.187	58.093	0.702
	CV%	2.420	10.780	18.130	36.900	9.900	41.340
	S.E±	0.210	2.229	0.783	1.462	0.744	0.038
	LSD(5%)	2.375	26.984	9.018	17.753	9.433	0.477

TABLE 3: PERFORMANCE DATA OF NAMIBIA PEARL MILLET EVALUATION TRIAL 1995/96 SEASON CONDUCTED AT MASHARE AGRICULTURAL DEVELOPMENT INSTITUTE.

No	Variety Name	Bloom	PHT	EL	HC	Thresh%	Yield T/Ha
1.	NPMV 94001	49.978	218.105	30.802	71.392	62.956	2.404
2.	NPMV 94002	47.667	223.333	27.333	54.667	61.667	2.184
3.	NPMV 94004	46.333	193.333	27.000	45.333	66.667	1.811
4.	IP 17531	46.228	165.605	20.052	49.142	65.706	1.490
5.	NPMV 94003	46.667	203.333	22.000	46.000	61.667	1.404
6.	NC-90	52.333	210.000	27.333	41.667	61.333	1.251
7.	BBC4F1(LRxOk)	52.000	180.000	23.000	54.333	58.000	1.231
8.	SDMV 92036	56.667	256.667	30.333	33.667	57.333	1.183
9.	BBC4F1(LRxWC)	49.478	238.105	29.552	47.892	56.956	1.171
10.	Okashana-1	48.333	176.667	21.667	46.333	57.333	0.997
11.	NPMV 94009	47.500	191.667	22.500	31.500	58.333	0.953
12.	Maria Kaherero	50.000	216.667	25.000	35.333	58.667	0.907
13.	NPMV 95001	51.000	206.667	25.000	44.667	58.333	0.897
14.	NPMV 94005	51.122	213.871	22.532	38.409	63.420	0.882
15.	HHVBC	48.000	166.667	25.000	46.000	55.000	0.798
16.	SDMV 92035	54.000	236.667	33.333	38.667	51.667	0.747
17	NPMV 95002	52.622	193.871	25.282	34.40	61.170	0.745
18	NPMV 94006	52.667	230.000	27.667	29.333	58.000	0.705
19.	WGC	50.000	200.000	25.333	39.667	57.333	0.701
20.	SDMV 93032	49.622	176.371	24.282	33.659	52.170	0.643
21.	NPMV 94008	55.333	220.000	25.333	27.333	63.000	0.611
22.	NPMV 94007	53.728	195.605	30.052	26.642	56.456	0.605
23.	SDMV92034	59.000	223.333	30.667	30.000	54.333	0.558
24.	F.Local	63.728	250.605	28.802	17.142	58.956	0.538
25.	SDMV 92038	64.000	226.667	30.333	9.333	58.333	0.302
Mean :		51.947	208.400	26.467	38.973	59.200	1.021
CV%		6.350	8.770	18.160	35.040	10.000	54.040
SE±		0.643	3.277	0.576	1.914	0.776	0.076
LSD(5%)		5.426	30.181	7.913	22.494	9.739	0.917