NAMIBIA NATIONAL SORGHUM AND PEARL MILLET IMPROVEMENT PROGRAMME

A PROPOSAL FOR RELEASE OF PEARL MILLET VARIETIES

SDMV 93032 (Okashana 2)

SDMV 92040 (KANGARA)

By

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PROPOSAL FOR THE RELEASE OF PEARL MILLET VARIETIES SDMV 93032 (OKASHANA 2) AND SDMV 92040 (KANGARA)

INTRODUCTION

Pearl Millet is the most important cereal and a staple crop in Namibia. It is widely grown in seven regions of Namibia namely: Caprivi, Kavango, Oshikoto, Ohangwena, Oshana, Omusati and Kunene covering about 355200 ha of land. Save for Okashana 1 a popular variety released in 1990, much of the cultivated hectarage is dominated by local which are tall and of long maturity range (up to 120 – 150 days). These local cultivars are also characterized by low yield potential (250- 300 Kg/ ha). In addition, these local cultivars respond poorly to improved management practices. In spite of these shortcomings, farmers still prefer them, because they have hard kernel which store well, strong stalks that do not lodge easily and have good food quality values.

Most improved pearl millet varieties available in the SADC region are high in grain yield but have not yet been accepted widely by the traditional pearl millet growers and consumer in Namibia. This is because most of them lack the grain quality characteristics found in the local millet.

SADC initiated the Regional Sorghum and Millet Improvement Programme SADC/ ICRISAT SMIP in 1984 at Matopos Research Station 30 Km south of Bulawayo Zimbabwe as the Regional Centre, to meet and answer the need of farmers, through the provision of improved and acceptable cultivars for farmer use in member states.

Materials developed at Matopos are made available to Namibia through a series of trials and facilitated by regular interactions and monitoring tours. From series of such regional trials, cultivars with good potential are selected and promoted into further trials and included along with those developed directly by the Namibian National Breeding Program into National Preliminary and Advance multi – location testing. It is from such trials that the varieties SDMV 93032 and SDMV 92040 being proposed for release were identified for their superiority in terms of yield and other agronomic attributes.

It should be noted that these varieties are not intended to replace Okashana- 1 but rather to compliment it and to allow farmers to have a wide range of choices.

MATERIALS AND METHODS

SDMV 93032 "Okashana 2"

Origin and Development

SDMV 93032 Pearl Millet (*Pennisetum glaucum* (L) R. Br.) grain cultivar was developed by the Southern African Development Community (SADC) / ICRISAT Sorghum and Millet Improvement Program (SMIP) at Matopos Research Station near Bulawayo and Muzarabani off season locations in Zimbabwe. This variety is a second Backcross (BC 2 F1) derivative involving a Zimbabwe local landrace variety SDGP 1514 (IP16504) CROSS WITH ICMV 87901 and ICMV 88908. The local landrace variety (LLV) was selected for its strong stalks, and hard vitreous endosperm kernels. ICMV 87901 and ICMV 88908 were selected for their early maturity and large bold grains. The initial cross between SDGP 1514 and ICMV 87901 was made at Muzarabani during the off season of 1989. The resulting F1 was planted at Matopos during main season 1990, and crossed to ICMV 88908. The second backcross with ICMV 88908 was made during off- season 1990. In all cases the LLV (IP16504) was the recurrent parent. During 1990 / 91 main season, the BC2F1 seed was multiplied in isolation at Matopos where gridded mass selection was practiced. All late flowering plants (> seven days outside the range of ICMV 88908 with improvements in stalk strength and tillering ability were retained. This procedure was repeated during 1991/ 92 main season, and the selected plants bulked and evaluated along with other local landrace derived varieties across two sites in Zimbabwe during 1992/ 93 main season. This backcross derived variety {[(SDGP 1514 x ICMV 87901) x ICMV87901) x ICMV 88908] x ICMV 88908} was renamed SDMV 93032 in 1993. It therefore took a total of six seasons three years) to develop SDMV 93032 from the initial cross made in 1989.

SDMV 92040 "Kangara"

Origin and Development

"SDMV 92040" a white seeded pearl millet (*Pennisetum glaucum* (L.) R. Br,) variety was developed by the Southern African Development Community (SADC) / ICRISAT sorghum and Millet Improvement Programme (SMIP) at Matopos Research Station in Zimbabwe. The constituent components of this variety are two accessions IP 17527 and IP 17531 and four S2 progenies from the SADC white Grain Composite (SDWGC). These were identified from two different nurseries (Bold
Seeded line evaluation trial and (SDWGC) progenies evaluation) grown at Matopos and Omahenene Research Stations respectively during
Main season 1990/ 91. Selected selfed plants (five each) from IP 17527 and IP 17531 and four S2 progenies from SDWGC were recombined in a diallel fashion during off- season 1991. Equal proportions of the resulting 91 crosses without reciprocals) were grown out in an isolation block during main season `1991/ 92 and allowed to random mate. Grid mass selection was practiced to retain only those plants that were all white seeded, with large bold grin and

early maturing (50- 55 days to reach flowering). Continuous Grid mass selection was practiced each year, through which weak plants were discarded before flowering. As a result of this selection method SDMV 92040 was constituted.

METHODS

Due to their potential, the new varieties were further evaluated across the region in regional collaborative trials between 1992/ 93 and 1993/ 94 respectively. From here they were promoted into a series of trials in Namibia starting from the Namibian Pearl Millet Initial Trials 1 & 2 (one and two) for further verification of their yield potential and adaptability across number of sites. SDMV 92040 and SDMV 93032 were evaluated in multi-location national variety testing trials across all major pearl millet growing areas of Namibia. All data obtained from these randomized and replicated trials in which SDMV 92040 and SDMV 93032 were included as test entries, were analyses for location and year / season effects through the analysis of Variance method, and their means compared by the appropriate statistical test

RESULTS AND DISCUSSION

ON – STATION EXPERIMENTS

Table 1 shows the grain yield in tonne per hectare of SDMV 92040 and SDMV 93032 in seven Pearl millet trials conducted in Namibia for four years across 40 environments. During 1992/ 93 and 1993/ 94 SDMV 92040 was tested at three locations namely: Omahenene, Ogongo and Mashare providing for six environments altogether. The means of the yield across the six environments in two different trials show SDMV 92040 yielding on the average 3.359 t/ ha in the Pearl Millet Variety Trial and 2.199 t/ ha and in the Namibian Pearl millet Initial Trial – 1, relative to the farmers local which yielded 2.665t/ ha and 1.539 t/ ha respectively. SDMV 92040 was superior to the farmers' local in 25 out of the 31 test site environments where their yield performances were compared side by side. In addition, it yielded more than the farmer's local in 23 out of the 30 environments where trials were conducted since 1994 in which it was included as a test entry, giving an overall yields of 1.361 t/ ha compared to the farmers `s local 1.187 t/ ha which translates to 15 % yield superiority.

Table 2 displays days to 50 % bloom of these varieties compared to the two variety Checks of Okashana -1 and farmers Local across forty environments in for years of testing. SDMV 92040 took an average of 53 days while SDMV 93032 took 55days to reach 50% flowering across sites compared to 63 days taken by the farmers local. This means SDMV 93032 and SDMV 92040 flower much earlier between ten and eight days respectively across sites in comparison to farmers local. Both SDMV 93032 and SDMV 92040 are about 0.5 m shorter than farmers local , but have head length similar to Okashana -1 (Tables 3 and 4). Table 5 reveals that SDMV 93032 has stalk strength improvement as compared to Okashana – 1, as measured by lodging resistance. This is one of the major improvements over and above Okashana 1 known stalk weakness.

ON – FARM TRIALS

In a study with a woman group called Tunetu Women `s cooperative Project based at Tsandi in Omusati Region carried out 1994 / 95 , SDMV 92040 was identified as a variety that satisfies most of the farmers' requirements. This variety is of short duration and with drought escape mechanism similar to Okashana 1, produced a better tasting product, is easier to dehull and grid into flour. It was superior to the farmers' local in many aspects of grain quality traits. In another study carried out for two seasons by an ODA supported project known as the Kavango Farming Systems Research and Extensions in their two focus communities of Mbora and Shikoro, SDMV 92040; Okashana 1 and SDMV 93032 scored high marks on the farmers matrix ranking in terms of earliness , palatability and preference. Farmers in these two focus communities commended SDMV 92040, Okashana 1 and SDMV 93932 for the compact seed head and bold grains.

Grain Quality for End Uses

Laboratory test were carried out on eleven pearl millet varieties among them Okashana 1; SDMV 92040 and SDMV 93032 which were under on farm testing in Namibia during 1994/ 95 season. A total of thirteen (13) physical and physio – chemical traits were evaluated for these varieties. Table 6 shows that SDMV 93032 has the second biggest grains with the size fractions of grains being 55.3% large and 43.29 % medium, has heavier grains (1.33g/100) and with high milling yields of 82.3%.This compares favourably to Okashana 1 milling yield of 82.2 %. What is of important to note, is that, all traits preferred by the farming community, (large grain size, ease of dehulling, and high milling yields) are present in these varieties.

JUSTIFICATION FOR RELEASE

SDMV 92040 and SDMV 93032 are short duration varieties which are high yielding with exceptionally excellent drought escape mechanisms. Release of these varieties will have several positive spillover effects on the farmers' livelihood as they will not only improve the farming communities' household food security but will also increase crop productivity. These varieties have been widely tested across a range of environments in Namibia and are liked by the farmers. These varieties are recommended for release to compliment an already released variety Okashana -1 in order to increase the range of choice to farmers in line with our overall objectives of providing high yielding open pollinated varieties to the community. These varieties are all bold seeded, early maturing, will therefore complement Okashana -1 for a range of end users including composites flour. SDMV 93032 is an improvement over and above Okashana 1 as having improved traits which were identified as weakness in Okashana – 1.

CONCLUSION

These varieties possess important plant and grain traits the Namibian Farmer looks for in an improved variety, these being among others bold grains, high yield, low dehulling loss, easy processing and palatability. These varieties are therefore recommended for release to the

general farming community under the proposed names of "KANGARA**" and OKASHANA 2** respectively.

Table 1. summary of performances of new Pearl Millet varieties versus Okashana 1 and farmers` Locals across Namibia from 1992/ 93 to 1995 / 96 seasons

Trial +	Years	# of sites	SMDV 92040	SDMV 93032	OK-1	FL	SE#	CV%
PMVT	1992/93	3	3.359*	-	2.398	2.665	0.255	27.500
NPMIT- 1	1992/93	3	2.199*	-	1.912	1.539	0.184	30.400
NPMANT	1993/94	4	0.973*	-	0.883	0.778	0.100	35.900
NPMIT-1	1994/ 95	3	1.359	1.395	1.591	0.936	0.171	36.570
NPMIT-2	1994/ 95	3	-	1.957	1.579	1.292	0.191	36.640
PMVAT	1994/ 95	1	1.232	1.925	1.511	1.312	0.238	25.120
STCET	1994/ 95	2	-	1.744	1.890	2.636	0.347	35.800
NPMANT	1994/ 95	4	-	1.404	1.521	1.012	0.156	38.300
NPMANT	1995/ 96	4	1.179*	1.061	1.167	0.822	0.244	43.080
NPMIT-1	1995/96	6	1.093*	1.173	1.398	0.829	0.127	48.840
STCET	1995/96	1	0.827	1.090	0.820	1.076	0.139	23.110
PMRCT	1995/96	6	1.291	1.229	1.339	0.853	0.119	47.910
Across sites -		*40*	*1.667*	*1.361*		*1.481*	*1.187*	-

Significantly different from farmers' local

+ PMVT - Pearl Millet Variety Trial
NPMIT-1 - Namibia Pearl Millet Initial Trial – 1
NPMIT – 2 Namibia Pearl Millet Initial Trail – 2
NPMANT Namibia Pearl Millet Advance National Trial
PMAVT Pearl Millet Advanced Variety Trial
STCET Single / Top Cross Hybrid Evaluation Trial
PMRCT Pearl Millet Regional Collaborative Trial

Table 2. Performance of new Pearl Millet varieties versus Okashana 1 and Farmers' Local across sites and seasons for other traits of interest: Days to 50% Bloom

Trial+	Years	# of sites	SMDV 92040	SDMV 93032	OK	F.L.	S.E#	CV%
PMVT	1992/93	3	48	-	47	61	0.800	4.900
NPMIT- 1	1992/93	3	50	-	48	63	0.945	5.500
NPMANT	1993/94	4	55	-	56	61	1.081	7.700
NPMIT-1	1994/ 95	3	61	64	66	77	1.010	4.630
NPMIT-2	1994/ 95	3	-	64	71	77	1.095	4.920
PMVAT	1994/ 95	1	75	73	73	77	1.211	2.760
STCET	1994/ 95	2	-	46	47	52	1.053	5.330
NPMANT	1994/ 95	4	-	60	63	70	1.481	8.230
NPMANT	1995/ 96	6	55	53	52	67	1.214	9.500
NPMIT-1	1995/96	1	51	49	53	62	3.593	11.270
STCET	1995/96	4	46	52	50	57	1.116	7.530
PMRCT	1995/96	6	51	50	48	60	0.853	8.130
Across sites		40	53	56	55	63	----	-----

Table 3. Performance of new pearl millet varieties versus Okashana 1 and farmers` local across sites for traits of interests: plant height in centimetres

Trial+	Season	# of sites	SMDV 92040	SDMV 93032	OK-1	F.L.	S.E#	CV%
PMVT	1992/93	3	177	-	154	226	5.373	9.400
NPMIT- 1	1992/93	3	181	-	168	212	5.800	10.000
NPMANT	1993/94	4	138	-	131	143	4.890	14.200
NPMIT-1	1994/ 95	3	177	194	191	233	5.668	8.660
NPMIT-2	1994/ 95	3	-	183	189	216	5.578	8.370
PMVAT	1994/ 95	1	183	192	188	245	10.812	9.370
STCET	1994/ 95	2	-	155	157	192	6.354	10.230
NPMANT	1994/ 95	4	-	178	182	220	6.063	11.410
NPMANT	1995/ 96	6	155	158	153	191	3.996	10.860
NPMIT-1	1995/96	1	154	146	152	184	8.225	9.590
STCET	1995/96	4	168	175	158	193	6.871	13.900
PMRCT	1995/96	6	155	157	155	196	4.075	12.330
Across sites		40	162	169	167	206	----	-----

Table 4. Performance of new pearl Millet varieties versus Okashana 1 and Farmers Local across sites and season for traits of interest; Ear length in centimetres

Trial+	Season	# of sites	SMDV 92040	SDMV 93032	OK-1	F.L	S.E#	CV%
PMVT	1992/93	3	24	-	23	42	1.619	17.300
NPMIT- 1	1992/93	3	24	-	25	35	1.400	16.100
NPMANT	1993/94	3	21	-	18	30	0.913	13.600
NPMIT-1	1994/ 95	3	21	22	27	35	1.449	16.070
NPMIT-2	1994/ 95	3	-	22	27	31	1.267	13.670
PMVAT	1994/ 95	1	22	22	17	30	1.883	13.930
STCET	1994/ 95	2	-	21	20	31	1.313	13.470
NPMANT	1994/ 95	4	-	21	22	33	1.195	16.140
NPMANT	1995/ 96	6	21	23	21	33	0.966	17.160
NPMIT-1	1995/96	1	23	21	23	27	2.174	14.650
STCET	1995/96	4	23	26	24	31	1.858	23.950
PMRCT	1995/96	6	22	23	23	34	0.808	15.760
Across sites		39	22	23	23	33	-	-

Table 5. Performance of SDMV 93032 vs. Okashana -1 and Farmers local across sites for plant lodging (%)

Trial	# of sites	SDMV 93032	Okashana - 1	F.Local	Mean	Se#	CV %
PMDT	1	15	20	14	21.25	3.448	32.45
PMAVT	2	25	29	24	31.00	5.509	31.01
PMPHT	1	19	44	14	35.33	9.933	48.99
PMBLT	1	18	39	23	30.00	6.060	35.15
MDGON	2	16	39	5	12.63	4.096	79.42
PMSCTCT	1	30	31	21	27.36	4.809	30.44
Across Sites	8	20.5	31.25	16.25	-	-	-

*** PMDT = Pearl Millet Drought line Trial**
PMAVT = Pearl Millet Advance Varieties Trial
PMPHT = Pearl Millet Preliminary Hybrids Trial
PMBLT = Pearl Millet Bold Lines Trial
MDGON = Morphologically Diverse Germplasm Observation Nursery
PMSCTCT = Pearl millet Single Cross Top Cross Trial

Table 6. Grain Quality Evaluation (GOE) of new Pearl Millet varieties

Traits	Cultivars		
	SDMV 92040	SDMV 93032	Okashana 1
Grain Colour	Cream / white	Light grey	Light grey
Size Fractions %	L50.58	L55.30	L72. 49
	M48.80	M43.29	M27.25
	S 0.14	S0.09	S0.06
Kernel wt. (g/ 100 kernels)	1.29	1.33	1.70
Visual Hardness Score	2.0	3.0	2.1
Proportion Floury Endosperm	0.60	0.43	0.56
My (%)	88.8	82.3	82.2
DHL (%)	5.1	6.5	6.3
FLT (%)	67	32	49
WA (%)	10.3	11.3	9.7
Agtron Reading - Dry	60.7	45.2	52.75
Diastatic Power (PMDU)	46.63	36.12	25.75
Alpha – Amylase Activity	44.65	38.96	24.93

Key

My Milling yield
DHL = Dehulling Loss
FLT= Floaters
WA= Water Absorption (30)
PMDU= Pearl Millet Diastatic Unit
Nb= the units for measuring alpha- and
Beta – amylase activities are Diastatic Units

Size Fraction Scale:

L=Large (> 2.6mm**)**
M= Medium (2.6 to 1.7mm)
S= Small (<1.7 mm)

Visual Hardness Scale
1.0 = very soft
2.5= Intermediate
4.0 = very hard