African Crop Science Journal, Vol. 12. No. 3, pp. 223-228, 2004
Printed in Uganda. All rights reserved
ISSN 1021-9730/2004 $ 4.00

AGRONOMIC EVALUATION OF SWEETPOTATO VARIETIES

M.N. SHIGWEDHA[1], B.R. BRAUN[2] and S.M LAURIE[3]
[1]Ministry of Agriculture, Water and Rural Development, Private Bag 13184, Windhoek, Namibia
[2]P. O. Box 2992, Windhoek, Namibia
[3]Agricultural Research Council Roodeplaat Vegetable and Ornamental Plant Institute, Private Bag X293, Pretoria, 0001, South Africa

ABSTRACT

The Namibia Root Crop Research Project has conducted sweetpotato *(Ipomea batatas)* variety evaluation for acceptable agronomic trials. Varieties Blesbok, Yan Shu 1, Xushu 18 and Ribbok were recommended for release in the northern Namibia. Varieties Jewel, Excel and TIS3290 performed above average under irrigated conditions at Mannheim. Varieties Excel, Kemb 10 and Nemanete were also highly promising. Varieties 1986-12-4, 1997-14-16, 1989-17-1 (Monate) and 1984-10-340 (Mamphenyane) showed average and above average performance. Varieties with good tuber yield and other agronomic criteria were selected for further evaluation.

Key Words: *Ipomea batatas*, marketable yields, Namibia

RÉSUMÉ

Le projet de recherche sur les racinesss alimentaires en Namibie était conduit l'évaluation des variétés de la patate *(Ipomea batatas)* douce pour la sélection dans le pays. Les variétés Blesbok, Yan Shu 1, Xushu 18 and Riddok étaient recommendées pour être larger au nord de la Namibie. La performance des variétés Jewel, Excel et TIS3290 était au dessus de la moyenne dans les conditions d'irrigation à Mannheim. Les variétés Excel, Kemb 10 et Nemanete étaient très prometteuses. Les variétés 1986-12-4, 1997-14-16, 1989-17-1 (Monate) et 1984-10-340 montrèrent une performance moyenne et au dessus de la moyenne. Les variétés avec un bon rendement en tubercules et autres critères agronomiques étaient sélectionner pour évaluation.

Mots Clés: *Ipomea batatas*, rendements vendables, Namibie

INTRODUCTION

Sweetpotato (*Ipomoea batatas*) is a major food security crop and income earner in southern Africa (Rusch, 1998). The crop is mainly used as a major staple among several households. In Namibia, sweetpotato is considered a key staple food especially in the communal areas of the Northern Namibia where it constitutes about 60% of the farming area under crop production. In this region, the crop is grown mainly for home consumption, therefore, the development of sweetpotato production has the potential to impact significantly on food security in Namibia. As in most other countries in southern Africa, yields are generally low (FAO, 1978) and there is a need for variety evaluation and selection.

The Namibia Root Crop Research Project (NRCRP) has taken a centre stage in variety evaluation trials to identify and recommend suitable varieties for Northern Namibia. Varieties Blesbok, Ribbok, Yan Shu 1 and Xushu 18

(Rusch,1998; Laurie *et al.*, 2002) performed well during trials from 1996/97 to 1998/99. Some of these, although high yielding, lack acceptable taste. Therefore, the NRCRP continues to evaluate more varieties to provide better options for farmers and identify varieties that have a broad-based adaptation. Namibia is prone to drought yet the rainy season is often short usually three to four months. Therefore, except for yield and taste suitable variety for Namibia should possess drought resistance and early maturity (Rusch, 1999; Braun *et al.*, 2002). In this paper results obtained from evaluation trials during 1999/2000 and 2000/2001 are presented.

MATERIALS AND METHODS

Novel varieties were imported from the germplasm collection of the International Potato Center (CIP), Lima, and from the sweetpotato breeding programme and germplasm collection at ARC-Roodeplaat Vegetable and Ornamental Plant Institute, South Africa. During 1999/2000, 39 varieties were obtained from ARC-Roodeplaat: 2 commercial cultivars, 21 ARC lines, six RSA land races and 10 CIP clones. Additionally, twenty varieties were imported directly from CIP. These were maintained and multiplied in the field genebank at Mannheim.

Nine varieties selected for final evaluation and one local check were evaluated in the advanced variety evaluation trials at four stations, Mahenene (Omusati Region), Mashare (Okavango Region), Hardap (Hardap Region) and Mannheim (Oshikoto Region). These varieties were acquired earlier in 1996 and were evaluated for the fourth season. In 2000/2001, 12 selected varieties from the preliminary evaluation trial of the 1999/2000 season and one local check were evaluated in the advanced variety trials at three research stations, Mahenene, Mashare and Mannheim. The layout of all the trials followed a randomised complete block design with three replications. Plot size was 4.5 m x 5.0 m long (60 plants).

Eighteen varieties of which 11 were new acquisitions (eight from CIP and three from ARC) and one local check were evaluated in the preliminary variety trials at two research stations, Mashare and Mannheim in 1999/2000. While in 2000/01 a local check and 26 initially selected varieties, 12 from the initial variety evaluation in 1999/2000 and 14 newly imported varieties, were evaluated in the preliminary variety trials at three research stations, Mahenene, Mashare and Mannheim in 2000/01. Eight more newly imported varieties and one local check were evaluated at Mannheim in a preliminary variety trial. In all cases, the trial layout followed a randomised complete block design with three replications. Eighteen varieties and Blesbok as check were evaluated in the initial non-replicated evaluation in 1999/2000.

In all trials, only tip cuttings were used but spaced at 0.30 m x 1.2 m. In three stations, Mahenene, Mannheim and Hardap, trials were irrigated while the Mashare trial was grown under dryland conditions. Rainfall for Mashare is presented in Table 1. Before planting, 2:3:2 (22) fertiliser was broadcast at 300 kg ha^{-1} for dryland trials and at 600 kg ha^{-1} or irrigated trials. Potassium nitrate was side-dressed once at 200 kg ha^{-1} for dryland trials and twice at 300 kg for irrigated trials. Growing periods of four months were allowed, except at Hardap in 1999/2000 where rain delayed the harvest.

The data collected was percent establishment, number of storage roots per plant, marketable yield per plot, percent small storage roots and dry matter yield. Yield data were subjected to analysis of variance (ANOVA) to generate treatment means determine significant differences between means.

RESULTS AND DISCUSSION

Advanced and preliminary variety evaluation trials of 1999/2000. Varieties Blesbok, Yan Shu 1, Xushu 18, Ribbok and Brondal performed very

TABLE 1. Rainfall (mm) at Mashare during 1999/00 and 2000/01

Months	1999/00	2000/01
December	177.1	68.5
January	274.7	35.4
February	79.9	160.8
March	225.0	45.2
April	28.8	105.0
Total	785.5	414.9

well in terms of number of storage roots and marketable yields at all test sites (Table 2). Blesbok and Ribbok ranked fairly poor in taste while Yan Shu 1 and Xushu 18 were acceptable. This was inspite of the fact that Blesbok produced the highest yield at all the sites. The higher yield obtained by these varieties under dryland conditions at Mashare, indicates that these varieties can also be regarded as drought tolerant. The good performance of Blesbok, Yan Shu 1, Xushu 18 and Ribbok led to their recommendation release for production in northern Namibia.

In the preliminary evaluation of 1999/2000, varieties Jewel, Excel, Kandee, Kemb 10 and Centennial performed above the average under irrigated condition at Mannheim (Table 3), and were selected for further evaluation in advanced variety evaluation trials in 2000/2001 season. Benikomachi, with the highest dry mass had poor yield. Yan Shu 1, Bosbok, Xushu 18, Kudu and Resisto gave reasonable yield on dryland at Mashare.

Advanced and preliminary variety evaluation trials of 2000/2001. The performance of some varieties (e.g. Excel and Kemb 10) in the advanced variety evaluation trial of 2000/2001 season was promising (Table 4). Furthermore, Nemanete performed well on dry land with good dry mass. Centennial did well at both dryland and irrigation, but unfortunately had lower dry mass. Virovsky was the best in dry mass yield but performed below average at both stations.

In the preliminary variety evaluation trial, there are clear performance differences between various varieties (Table 5). Varieties with average performance were 1986-12-4, 1997-14-16, 1989-17-1, 1984-10-340 and 1994-8-1. Narunmitang did well on a dryland, yet 1994-8-1 had good yield but not dry mass. These varieties were, therefore,

TABLE 2. Storage roots yield of ten sweetpotato varieties evaluated in advanced trials at four stations during the 1999/2000

Variety	Mashare		Mannheim		Mahenene		Hardap	
	Root	Marketable	Root	Marketable	Root	Marketable	Root	Marketable
	yield (t ha^{-1})							
Blesbok	10.5	53.03	6.12	50.49	8.47	28.96	7.11	79.51
Yan shu 1	5.59	39.01	6.21	43.53	8.96	26.74	6.27	55.83
Xushu 18	6.81	13.38	4.09	28.2	5.81	18.27	7.13	54.83
Ribbok	9.34	42.93	3.79	33.23	5.61	18.06	6.21	57.09
Mafutha	4.31	30.39	2.60	17.99	3.30	16.92	4.69	40.47
Brondal	8.81	29.12	2.23	30.92	3.54	15.39	2.87	52.10
Japon TS	3.64	8.02	2.13	27.45	1.34	14.82	3.82	34.95
LM88.014	2.32	17.17	3.75	5.54	0.64	9.56	4.34	21.94
Local check	5.46	15.57	2.03	34.55	4.1	2.26	4.5	42.49
Chingovwa	3.31	18.94	2.28	7.46	2.58	1.29	3.14	22.35
STDV	3.07	15.57	1.79	14.29	2.83	9.12	1.87	17.4
F-value	6.28	8.38	6.01	33.77	13.41	13.04	4.00	10.68
P-value	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00

TABLE 3. Yield performance of sweetpotato varieties and a local check evaluated in preliminary trials at Mashare and Mannheim Research Stations during the 1999/2000 season

Variety	Mashare		Mannheim		Dry mass (%)
	Roots plant^{-1}	Marketable	Roots plant^{-1}	Marketable	
			yield (t ha^{-1})		
Jewel	-	-	5.85	36.66	34.44
Excel	-	-	4.72	27.41	35.67
TIS3290	3.61	11.62	4.69	27.12	36.67
JaponTS	1.49	9.55	2.99	26.60	32.11
Yan Shu 1	5.69	26.35	2.91	25.16	27.44
Xushu 18	3.09	19.70	2.71	25.07	31.56
1994-29-2	3.21	6.69	4.13	24.56	33.56
Kudu	4.31	16.46	3.53	22.39	28.00
Resisto	5.32	13.13	5.07	20.26	30.33
Kandee			3.28	18.38	40.11
Centennial			3.16	18.00	34.67
Bosbok	4.87	22.35	3.74	16.04	28.00
Virovsky	2.66	5.75	3.84	15.37	29.78
Kemb 10			2.26	12.68	36.89
Local check	0.44	0.97	1.5	11.80	34.67
Nemanete			2.00	5.1	34.11
Benikomachi			2.51	4.73	40.22
LM88.014	3.79	3.58	2.37	4.48	29.78
Magwa	0.87	2.61	0.83	1.47	33.56
Mean	3.28	11.56	3.30	18.10	33.24
STDV	1.84	8.49	1.51	9.49	4.30
F-value	8.63	15.98	4.47	13.71	6.32
P-value	0.00	0.00	0.00	0.00	0.00

TABLE 4. Number of roots harvested per plant and average marketable yield (t ha^{-1}) of 12 sweetpotato varieties evaluated in advanced trials at three research stations during 2000/2001 season

Variety	Mashare		Mahenene		Mannheim		Dry mass (%)
	Roots plant^{-1}	Marketable	Roots plant^{-1}	Marketable	Roots plant^{-1}	Marketable	
				yield (t ha^{-1})			
Jewel	4.01	0.73	4.94	19.95	3.88	24.93	36.44
Excel	3.01	13.81	2.54	17.21	3.88	44.07	35.11
TIS3290	3.70		3.50	12.64	3.41	25.11	31.83
Kudu	4.77		2.25	12.23	3.27	27.96	33.78
Kemb 10	2.16	9.01	2.52	11.86	3.28	42.74	34.56
Centennial	2.36	12.69	3.64	10.86	2.83	43.80	33.33
Resisto	3.78	1.67	3.64	9.42	4.32	16.56	35.00
Kandee	1.97	7.71	2.50	9.00	2.06	7.75	29.83
Nemanete	1.15	11.24	3.04	8.7	1.62	23.86	36.22
Local check	0.21	5.52	4.64	8.08	3.18	25.29	30.67
1994-29-2		8.1	3.40	6.52	2.94	33.39	35.00
Virovsky			5.30	6.15	4.37	25.1	39.17
Bosbok		5.24	4.00	3.18	4.71	11.75	35.17
Mean	2.74	7.63	3.64	10.51	3.37	27.07	34.48
STDV	1.5	4.61	1.06	4.77	1.09	12.59	2.52
F-value	11.17	8.31	3.86	5.95	3.72	5.37	6.58
P(a=0.05)	0.00	0.00	0.00	0.00	0.00	0.00	0.00

TABLE 5. Yield of 26-sweetpotato varieties evaluation in preliminary trials at Mannheim, Mahenene, and Mashare research Station during the 2000/2001 season

Variety	Mashare		Mahenene		Mannheim		Dry mass %
	Roots plant^{-1}	Marketable	Roots plant^{-1}	Marketable	Roots plant^{-1}	Marketable	
	yield (t ha^{-1})						
Narunmitang	8.62	11.19	5.41	5.13	2.82	12.10	36.44
1986-12-4	6.85	12.10	4.01	12.06	3.54	13.89	33.00
1989-23-1	5.17	13.86	4.85	11.41	3.24	11.46	28.44
1997-14-16	4.09	15.65	3.97	13.72	4.08	23.68	32.33
1984-10-340	4.08	9.79	2.89	7.48	4.08	13.09	33.78
W-208	3.97	3.39	2.01	5.50	2.24	8.55	35.11
1989-17-1	3.74	12.54	2.79	10.88	3.29	21.01	32.67
1997-1-1	3.73	4.34	2.56	2.33	2.75	5.88	30.56
Comensal	3.67	8.50	4.17	5.73	2.54	9.26	32.22
1984-2-201	3.58	8.93	3.04	7.43	2.53	3.47	30.11
TIB 4	3.57	3.25	3.94	4.09	4.45	12.10	36.22
1994-8-1	3.52	10.934	4.13	16.12	5.24	34.54	30.78
1992-4-2	3.51	12.85	2.52	10.53	1.85	9.35	32.22
1997-9-3	3.28	8.93	3.15	5.17	1.99	4.45	33.33
Beniasuma	3.25	5.92	1.49	2.93	1.95	3.92	35.00
Papota	3.13	8.41	1.64	2.25	1.29	6.05	34.89
W119	2.72	7.80	1.65	4.16	2.38	11.04	34.56
Tainung65	2.60	4.51	4.18	11.25	3.50	6.68	33.22
Anarandjado	2.42	3.26	2.46	8.02	2.29	6.68	33.44
Regal	2.35	3.51	2.39	2.83	1.79	5.34	31.33
Kurikogane	2.24	5.26	1.09	2.34	2.36	22.44	33.89
Tainung64	1.78	3.11	2.61	4.97	2.89	2.85	37.33
Lanceolado	1.72	7.10	3.21	7.66	3.60	14.25	31.22
Abees	1.61	4.18	4.95	12.97	2.30	20.12	33.78
Tugela Ferry	0.84	3.07	1.36	5.45	1.94	3.47	32.33
LM88-082	0.76	0.86	2.77	4.72	2.34	3.47	34.56
Local check	0.69	3.16	3.11	8.46	2.90	17.27	31.78
Mean	3.01	5.56	2.93	5.84	2.64	9.42	32.38
STDV	2.07	3.16	1.56	3.20	1.41	5.57	2.90
F	5.60	8.74	3.46	11.29	0.83	8.85	5.06

selected for further evaluation in the advanced variety evaluation trials.

ACKNOWLEDGEMENTS

We are grateful to the research technicians who managed the trials and collected data at various Research Stations. Thanks to ARC-Roodeplaat the Vegetable and Ornamental Plant Institution in South Africa for providing quality planting materials. Support from SARRNET is also appreciated

REFERENCES

Akoroda, M.O. and Teri, J.M. (Eds.) Polygraphics Venture Limited, Ibadan, Nigeria. pp. 115-127.

Food and Agricultural Organisation (FAO), 1978. Report on Agro-ecological Zones Project Vol. 1, Methodology and Results for Africa. World Soil Resources Report 48, Rome, Italy. p. 40

Laurie, S.M., Malemela, M.L., Magoro, M.D. Braun, B.R., Bok, I. and Nxumalo, M. 2002 Evaluation of selected sweetpotato breeding

lines and imported cultivars in the southern region of SADC. *Acta Horticulturae* 583: 95-101.

Rusch, B.R. 1998. The maintenance of sweetpotato planting materials in Namibia: Options for the development of a vine production and distribution system. M Inst Agrar thesis, University of Pretoria, South Africa.

Rusch, B.R. 1999. Sweetpotato production and research in Namibia. In: *Proceedings of the scientific workshop of SARRNET*, Pamodzi Hotel, Lusaka, Zambia, 17 - 19 Aug 1998.