

Sweetpotato Breeding for Southern Africa

Speed Breeders Workshop 2010: Building an Efficient and Innovative Sweetpotato Breeder Community of Practice

**Sweetpotato Breeder's Annual Meeting
Mukono, Uganda,
June 22-25, 2010**



OFSP breeding for drought prone regions of Southern Africa

- **Objectives: breed sweetpotato tolerant to drought with high levels of Beta-carotene and good culinary qualities**

Activities

- **Two populations –already available will be further developed. Within 4 years, 2 recurrent selection cycles will be carried out in both gene pools by accelerated breeding. Parents will be selected on the basis of clone with good performance**
- **The 2 populations will also be used to test the concept of exploiting heterosis. NARS breeding programs will be supplied and encouraged to use the resulting hybrid population for variety development**
- **Research activities on physiological drought mechanisms will be undertaken in cooperation with Agricultural Research Council-of South Africa**

- **Breeding programs take 7 to 8 years, to produce a variety**
- **Re-design breeding protocols to produce varieties in (3 to 4 years)**

- **“Accelerated Breeding”**

Multiply new breeding lines in screen houses, use more sites at earlier stages to substitute for fewer sites over longer periods of time.

There are 13 trials in Moz as result of ABreeding

- **Support NARS breeders to learn how to adapt this scheme to their own short term population improvement programs**

Summary of all Trials Established from August 2006 to December 2009 at Umbelúzi Research Station, Chokwe, Angonia, Gurue, and Maputo

Location	Type of Sweetpotato Trial	Nr. Trials	Number Genotypes/Seeds	
Umbelúzi¹	Seedling Nurseries	18	139,508	
	Clonal	16	14,907	
		1	382	
		1	1,575	
		1	1,015	
		1	1,019	
		1	7,251	
	Angonia³	Preliminary Yield Trial (PYT)	21	3,112
			1	206
	Gurue²	Advance Yield Trial (AYT)	59	1,258*
Multi-location Trial		34	344	
		4	64	
Drought Trial (DT)		3	58	
On-farm		205 +55+ 60		
	Total	481		

Seeds for Distribution & Varieties for release

- **From previous breeding program, 90,000 polycrosses seeds for distribution**
- **5,000 controlled cross**
- **Expect to have at least 10 more drought tolerant OFSP varieties to release**

Genotypes selected from Multi-location Trials with 64 clones, in 4 Environments, Cropping Season 2009/10 using Ranking, Index and AMMI analysis

G	Name	Location	VV1	RYTHa	RVY	BC	COOT1	INDEX
50	Ejumula -25	Umbeluzi Chokwe	5.44	18.83	16.94	6.01	3.63	13.30
34	UW119 06-289	Chokwe Gurue	5.75	21.58	14.89	7.70	3.44	13.59
43	Kakamega-7	All	5.88	19.63	20.32	6.06	3.75	14.23
13	UW119 06-284	Umbeluzi Gurue Angonia	5.13	19.55	16.07	10.16	3.63	13.83
41	105369-4	Umbeluzi Gurue	5.75	23.38	23.17	5.54	3.44	16.10
51	MUSG 0616-18	All	5.06	20.22	17.11	10.32	3.81	14.65
26	UW119 06-175	All	5.56	25.94	19.33	8.39	3.38	15.36
23	UW119 06-79	All	5.44	22.49	22.96	8.39	3.63	15.05
27	UW119 06-140	All	5.19	18.32	16.52	9.94	3.75	13.50
49	W119-15	Umbeluzi Chokwe	5.31	27.09	23.97	5.71	3.44	14.80
38	Tacna-2	All	5.69	22.16	25.39	5.31	3.38	15.62
37	LO323-1	Gurue Angonia	5.69	17.53	21.18	5.59	4.05	13.89
47	Mafutha-1	Umbeluzi Gurue Angonia	6.44	17.31	31.03	5.00	4.13	15.69
10	MUSG 0603-02	Chokwe	7.75	18.60	15.79	4.72	3.93	13.58
59	Ejumula	Angonia	5.50	14.90	26.80	5.38	4.03	14.88
LSD (0.05)			1.28	9.75	11.66	2.29	0.53	2.35
MEAN*			5.26	14.60	19.01	6.01	3.70	12.92

General Analysis of Variance for the 58 Clones in the Drought Trial 2006/08

Source	DF	Type III SS	Mean Square	F Value	Pr > F
Regime	1	963.398453	963.398453	61.77	<.0001
Rep	2	8.283680	4.141840	0.27	0.7669
Trt	57	6637.426717	116.446083	7.47	<.0001
Regime*Trt	57	2249.593658	39.466555	2.53	<.0001

The average yield for the irrigated trial (6.27) & for dry (3.82)

Clones with good performance in both Drought and Irrigated conditions

There are clones that performed better under drought (**Xitsekele**) than wet condition

Training in virology



- ***New kitchen/laboratory:*** A new kitchen/lab and a thermotherapy machine installed at IIAM. These facilities will improve the capacity of the virologist, post-harvest team and partners in developing new products and services. **Thermotherapy** enables IIAM to become a center for **diagnosing viruses** in Southern Africa and cleaning up of diseased material



The new screen house for virus cleaning and indexing (grafting)



Collaboration



Collaboration with Ivonne Muocha on molecular characterization of parental material for crossing block at Biotech Lab of Eduardo Mondlane University

Capacity strengthening:

Masters coursework for breeding initiated by Jose Ricardo in drought-research fieldwork to follow

Current status of Sweetpotato Research and Development in Malawi

Aims:

High yield (>20t/ha); resistant/ tolerant to SPVD and weevil; give desired root quality and shape with wide/specific adaptability

- Breeding trials implemented in 7 on-station sites of different environmental conditions
- On-farm demos and trials implemented in 8 Agricultural Development Divisions in collaboration with Extension officers

Discipline	Name	% time on sweetpotato
Breeders (2)	Dr. Felistus Chipungu & Dr Ibrahim Benesi	75 & 15
Agronomists (2)	Obed Mwenye and P Ntonga	20 each
Pathologist	MM Soko	20
Technology transfer (2)	Maurice Matchombe & Sara Chilungo	30 & 40
Postharvest specialist	Pilirani Pankomera	30
Technicians	26	time ranges from 20 to 80
Seed System specialist	Dr. Erna Abidin	80

Current support of sweetpotato breeding

AGRA/DARS- for variety development

Irish Aid/CIP/DARS- Technology dissemination (Variety demos) and Seed systems

SARRNET/CIP- Post harvest

Current Status of Sweetpotato Research and Development in South Africa

Aims:

- Currently focuses on the development of orange-fleshed cultivars suited to the needs of resource-poor farmers
- Important traits: sweet taste, acceptable dry matter content, increased β -carotene content and good yield
- Additional traits: tolerance to drought; *Alternaria* and virus tolerance

Funding: IAEA – induced mutation; SASHA – drought tolerance

Discipline	Name	% time on sweetpotato
Breeders (3)	Ms S Laurie, Ms M Malebana & Dr L van Emmenes	95, 98 & 5
Drought Physiology, & Gene bank Manager	Mr. R Laurie & Ms N Myeza	100 & 25
Pathologist (2)	Mr. A Thompson & Mr. D Kandalo	10 & 5
virology (3)	Ms J Domola, Mr. K Mabasa, & Dr M Cloete	40, 25 & 20
P manager (2) & Researcher - scheme	Dr PO Adebola, Dr Ian du Plooy & Mr. J Viljoen	10, 10 & 15
Technicians (4)	Dr L van Emmenes, Mr. A ad Berg, Mr. M Mtileni, Mr. S Tjale	5, 90, 85 & 70
Students (2)	Ms L Zulu, MI L Marageni	100 each

Current Status of Sweetpotato Research and Development in Zambia

Breeding activities

Polycross with 30 parents
PYT to on-farm evaluation

Seed multiplication

- On-station and on-farm

Agronomic activities

Staking of sweetpotato for production
Chemical weeding of sweetpotato

Awareness

Promotion of varieties (farm field day, on-farm, multiplication and senzitation of policy maker to support sweetpotato work

Constrains

- Limited human resource capacity
- Lack of transport
- Limited funds for developmental activities

• Staff:

Discipline	Number	% time
Breeders	2	90
Agronomists	1	10
Pathologist	1	10
Virologist	1	10
Postharvest Technologist	1	5
Technicians	5	60

**Current support of sweetpotato breeding
Activities funded by GRZ and CIP**

Current status of Sweetpotato Research and Development in Madagascar

Last 5 years, received :

14 OFSP clones
10,000 botanical seeds

Evaluation and selection on station
(Advanced yield trial, multi-location)
and on-farm)

Agronomic trial

- Fertility trial
- Post-harvest trial
- Conservation (storage) trial

Multiplication of planting material

- January-May, 2010 farmers groups and FIFAMANOR sold 20 tons of vines (320,000 cuttings) for south-East region of Madagascar

Major problems associated with the work

Absence of pathologist, virologist,
entomologist and post harvest specialist

Staff	No	%Time
Breeders	1	40
Agronomist	1	100
Technicians	6	30-100
others	2	20

Funding source:

HarvestPlus
Norway
Malagasy Government

Current status of Sweetpotato Research and Development in Mozambique

Aims:

- **Focuses on the development of OFSP cultivars, High yield, tolerant to drought, desired root quality and shape with wide and specific adaptation**
- **Additional important traits: acceptable dry matter content, high level of β -carotene content**
- **Breeding trials implemented: in 4 on-station sites of different Agro-ecologies**
- **On-farm trials implemented in 4 sites with different Agro-ecologies n collaboration with Extension officers**

Discipline	Name	% time on sweetpotato
Breeders (2)	Maria Andrade & Jose Ricardo	60 & 95
Agronomists (3)	Abilio Alvaro Sergio Moniz Siteo Elias	80 100 100
Virologist	Adilia Viegas	90
Socio-economist	Naico Abdul	70
Post-harvest specialist	João Augasse Jequê Júnior	90
Field Technicians (4)	Abdul Arlindo Bie Francisca	Time ranges from 50 to 90
Green-house technician	Benildo	60

Current support of sweetpotato breeding

SASHA/AGRA/USAID - for pre-breeding & variety development

SASHA/USAID - Seed systems & Post-harvest

USAID- Technology dissemination

Summary of sweetpotato breeding activities in Malawi

Type of trial/Activity	Number of genotypes	
	in 2009	2010
Number of seed now available from trials (OP)		11,000
Seedling nursery	6000	Current= 4,000
Clonal evaluation trial	Orange= 195	
	White = 82	
Preliminary yield trial	15= Orange	
	6= white	
Advanced yield trial	11= Orange	
	23= white	
Uniform (Orange)	10	
On-farm	7	
Other Activities	2009	2010
Varieties released	0	0
Candidate clones due for release		3 orange
Number of clones now actively disseminated*		5= white 1= orange

Summary of Sweetpotato Breeding Activities in South Africa

Type of Trial/Activity	Number of genotypes	
	2009 trials	Selected in 2010
Crossing block		
Number of seed available OP	24 394	Harvesting
Number of seed available hand crosses	1259	0
Seedling nursery	9553	0
Initial evaluation	75	In progress
Preliminary Yield Trial	43	In progress
Intermediate Yield Trial	20 @ 2 loc	In progress
Advanced Yield Trial	26 @ 6 loc	In progress
Other activities		
Varieties released	2 OFSP	0
Candidate clones due for release	0	1 OFSP
Number of clones now actively disseminated	5	5

Summary of Breeding Activities Zambia

Materials	Trial Name	Number of clones		Design
		2009	2010	
CIP-MOZ	Observational	0	542	Check plot
Local germplasm	AYT	25	24	RCBD
CIP-KENYA	PYT	18	17	RCBD
Hand pollinated-OFSP	PYT	49,16	25, 25	Lattice
Hand pollinated-cream	PYT	49,49	25, 25	Lattice
Open pollinated-OFSP	PYT	49,36	25	Lattice
Open pollinated-cream	PYT	16,36,49	16, 16, 49	Lattice
Naspot and Kanyasi	PYT	22	22	RCBD
G x E	UYT	25	25	Lattice
Open pollinated-comb	AYT	49	20	Lattice
On-farm	On-farm	2	5 (20)	Augmented RCBD

Summary of Sweetpotato Breeding Activities in Madagascar

Type of Trial/Activity	Number of genotypes	
	2009 trials	Selected in 2010
Number of seed available OP		
Number of seed available hand crosses	5,000	798
Seedling nursery	1,125	850
Initial evaluation (OT)	798 (genotypes with different flesh color)	
Preliminary Yield Trial		296 (138 genotypes OFSP and 158 (other flesh color)
Other activities		
Varieties released	1 (CIP199026.10)	0
Candidate clones due for release		2 (Zambezi, K56632) all OFSP
Number of clones now actively disseminated	8	

Summary of Sweetpotato Breeding Activities in Mozambique

Type of Trial/Activity	Number of genotypes	
	2009 trials	Selected in 2010
Crossing block	1	2
Number of seed available OP	90,000	
Number of seed available hand crosses	5,000	0
Seedling nursery	40,000	0
Initial evaluation	10,860	In progress
Preliminary Yield Trial	4	In progress
Intermediate Yield Trial	6 @ 4 loc	In progress
Advanced Yield Trial	12 @ 4 loc	In progress
Other activities		
Varieties released	0	0
Candidate clones due for release	0	15 OFSP
Number of clones now actively disseminated	8	8

On farm trial established in Angola



Planned activities and source of funding

Malawi:

- Crossing block - AGRA
- on-station and on-farm -AGRA/ Irish Aid
- Foundation vine seed- Irish Aid
- DVM- Irish Aid
- Process (flour) 4 biscuit (U. industries) & bread using mashed sweetpotato- CIP/ DARS
- Awareness campaigns OFSP- Irish/AGRA
- Value addition on sweetpotato- Irish aid/ AGRA/DARS

South Africa:

- Screening methods for drought tolerance
- Gamma irradiation to improve nutritional traits and drought
- Early selection, Multi-location advanced yield trials
- Maintenance in vivo/vitro gene bank
- Crossing with 199062.1 as female
- Evaluation of selected progeny (hybrids) from diallelcrossing in PYT

Zambia:

- Cross (among high DM OFSP in a diallel
- Evaluate breeding lines on-station/-farm
- Develop, promote & adopt OFSP recipes
- Promote sweetpotato weaning foods in health centers
- Multiply OFSP for Partners and Farmers

All these activities to be funded by the Government of Zambia

Madagascar:

- AYT of genotypes from seeds
- Observational trial of genotypes from seeds
- Multi-location trials of clones introduced in 2007 from CIP
- Planting material multiplication with released Varieties, on station
- Training of CBOs to assist the dissemination of new varieties and to tackle other areas

Planned activities and source of funding- Mozambique

- **Crossing block – SASHA**
- **On-station and on-farm –USAID/SASHA**
- **Screening for drought tolerance-SASHA**
- **Evaluation of seeds (crosses) in nurseries-SASHA/USAID**
- **OT, PYT, AYT and Multi-location-SASHA/USAID**
- **DVM- USAID**
- **Value addition on sweetpotato- Process (flour) 4 biscuit & buns using mashed sweetpotato- USAID**
- **Awareness campaigns OFSP- USAID**
- **Maintenance in vivo/vitro gene bank-SASHA/USAID**
- **Develop, promote & adopt OFSP recipes-USAID**
- **Multiply OFSP for Partners and Farmers-USAID**
- **Multiplication with released Varieties, On-station-USAID**
- **Training of CBOs to assist the dissemination of new varieties- USAID**

Collaboration with Other Partners

- **Networks & organizations on multiplication, dissemination, agro-processing & market related activities:**
- **(Millennium Village, SARRNET, HarvestPlus, VITAA, World Vision, Action AID, primary schools, bakeries, several associations etc.)**
- **Regional networking in SADC using a crop-based approach, with emphasis on OFSP funded by ICART-SADC**



Conclusion

- **Understanding factors that could reduce the negative effects of the environment on drought tolerant sweetpotato needed**
- **The sink source relationships and vine production, respectively, are significantly different between drought stress and non stress conditions**
- **More water does not translate into more yields.**
- **Promising beta-carotene-rich progeny have definitely emerged from both polycrosses and controlled crosses to-date**
- **Clones emerged from selection are more adapted than those currently in use and the vines are much more vigorous**
- **At least 10 clones will be released this year**
- **Seeds were shared with various countries in the region**
- **All countries in the region are in process of releasing OFSP**

Thank you for your
attention