Development of High Yielding Multiple Resistant Sweetpotato Germplasm

Gorrettie Ssemakula, ***Charles Niringiye, Milton Anyanga , Benard Yada, Craig Yencho, Robert Mwanga***

SWEETPOTATO ACTION FOR SECURITY AND HEALTH IN AFRICA

Objectives

Food security, Human health, Poverty thru development & deployment of:

- high yielding, pest resistant and adaptable sweetpotato varieties that meet consumer and market demands
- OFSP for combating VAD
- IPM & IDM packages
- Agronomic packages for optimal sweetpotato yields
- Seed systems technologies

Most important SP landraces in Uganda

Country/	Root yield	Flesh	Dry matter	Earl	SPVD	Alt	Remarks
Name of landrace	t/ha stn(farm)	color	(%)				
Uganda							
Ejumula	19 (15)	O	34	E	S	M	S to SPW, released 2004
Kakamega	15 (12)	LO	31-32	E	M	M	S to SPW, released 2004
Semanda	(25)	Cr	35	E	M	R	Commercialised along Masaka road
Dimbuka Bukulula	30 (16)	Cr	32-34	E	S	M	S to SPW, released 2007

Flesh color: White (w), cream (cr), yellow (y), light orange (lo),
Earl (Earliness: Early (E) (about 4 months), late (L) about 5 or more m
SPVD resistance (r: resistant, M: Moderate, s:susceptible)
Alt (Alternaria blight resistance, r: resistant M: Moderate s: susceptible

Most important bred SP varieties

Variety	Root yield t/ha	Flesh color	Dry matter	Early	SPVD	Alt	Remarks All Varieties are susceptible to SPW
NASPOT 1	29(20)	Y	35-36	E	M	S	Released 1999
NASPOT 8	20 (16)	O	32-34	E	M	M	Released 2007
NASPOT 10 O (Kabode)	18 (12)	O	28-32	E	M	M	Released 2007
NASPOT 11	38 (20)	Cr	30–36.0	E	M	R	Released 2010
NASPOT 13	38 (11)	O	31-33	E	M	R	Released 2013

Summary of progress 2009- 2014

Type of trial		Details	2009	2013/14
Crossing block				
	1	No. of parents in crossing block	24 (100)	28
	2	No. of seed collected from OP	536,104	513,049
		a. Total no. of families of OP seed	24 (97)	28
	3	No. of seed collected from crosses	4,765	5379
		a. Total no. of families of controlled crosses	56	34
Seedling nursery				
	1	No of seeds planted	-	691,958
	2	No of seedlings established	-	???
	3	Total no. of families planted	-	26+11 (crosses) + 32 (MZ)

Summary of progress 2009- 2014

Type of trial	Details	2009	2013/14
Observation trial			
(OT) 1	No of clones planted	15,316	see next slides
2	No of check clones planted	2	
3	No. of locations	1	
Preliminary yield (PT)			
1	No of clones planted	36	
2	No of check clones planted	2	
3	No. of locations	1	
Advanced yield trial (AT)			
1	No of clones planted	12 &10	
2	No of check clones planted	1&2	
3	No. of locations	4	

Trials planted 2013B(November)

TRIAL	Clones	Checks	Loca-tions	Total entries
ATY	12	5 (NK,NASPT 1, NASPT 11, DIMBUKA, NASPT 8)	4	17
AYT B	15	2 (9NASPT 8, NASPT 11)	4	17
PYT OSP	28	3 (NASPT 11, NK, NASPT8)	2	31
OT (OFSP)	68	2 (NASPT8, NASPT 11)	1	70
OT Non OSP	2124	2(NASPT 8, NASPT 11)	1	2126

Trials planted in April and May 2014, 3 locns

TRIAL	No of Clones	No. of checks	Total entries
ATY	12	5(NK,NASPOT 1, NASPOT 11, DIMBUKA, NASPOT 8)	17
AYT B	15	2 9NASPOT 8, NASPOT 11)	17
AYT N.O	15	2 (NASPT 11, NK)	17
AYT OFSP	7	3(NASPOT8, NASPOT11, NASPOT 10)	10
PTY OSP (2locs)	33	2 (NASPOT 8 , NASPOT 11)	35
PYT Non OSP (2locs)	461	2 (NASPOT 8, NASPOT 11)	463

Summary of progress 2009- 2014

Type of trial		Details	2009	2013/14
On-farm trials	1	No of farms/farmers per region/district / provinc		
			16 (MB trials)	10
	2	Total no. of trials whole country		
			48	50
No of varieties released			1 (2010)	2
No. of clones in pipeline for release by 2014				
Package used for		analysis		
2009-2012			GenStat? CloneSelector ? SAS?	Genstat, Clone selector
2013/14			?	Clone selector

Sweetpotato Foundation Seed system

Tissue culture lab:	Response (a)	Response (b)
No. of lamina flow benches (a)	2	
No. of CVs maintained in tissue culture (a)	3	
No. of screen houses/need repair (a)	2	
No. of good screen houses (a)	-	
No. of in vitro plantlets weaned:		
a) Every 3-4 months (b) every year)	??	
No. of vine cuttings:		
a) Distributed every 4-5 months (b) every year)		100,00-500,000
a) Sold every 4-5 months [(b) every year]	-	-
How long does it take to breed a variety (years)?		
How long does the variety release process take? (Assuming all data is available)/1 season/1 year (a)?	1 year	Variety release takes place at least once a year, process depends on demand for release

Linkage to Vine multipliers for further multiplication

Linkage to vine multiplies	%	Comment
Government institutions	%	Most multiplication takes place when there is a project that buys and distributes free to farmers
RwebiZardi, Ngezardi		
NGOs (list):	%	
COVOID, VEDCO etc…		
Farmer multipliers	%	
SOSPA, Basooka Kwavula,		
Others (list them)	%	
Harvest Plus for OFSP		

Status of AGRA grant (delete what is not applicable)

Project title:	
Development of Sweetpotato Varieties for Multipurpose Use in Uganda	**Approved**
Approved but has not started	**Yes**
Amount	**185,000**
Other information on AGRA grant:	**In process of signing contract**

Number of SP varieties released 2009 - 2014

No. of varieties released		No. of release document(s)*	No. of release papers /Manuscripts**
Non-orange	Orange		
1 (2009)	2 (2013)	2	1 +1**
No. of clones in pipe in pipeline for release (final tests/data already compiled)			
Non-orange	Orange		
8	4	-	-

** In the making

Variety release documents (2009-2014)

Mwanga, R.O.M., B. Kigozi, J. Namakula, I. Mpembe, C. Niringiye, S. Tumwegamire, R. Gibson, and C. Yencho. 2009. Submission to the Variety Release Committee for the release of sweetpotato varieties. National Agricultural Research Organization (NARO) / National Crops Resources Research Institute (NaCRRI), Kampala, Uganda. Pp42.

Ssemakula, G., C. Niringiye, M. Otema, B. Yada, G. Kyalo, J. Namakula, A. Alajo, B. Kigozi, R. Makumbi, C. Yencho and R.O.M. Mwanga. 2013. Submission to the Variety Release Committee for Release of Sweetpotato Varieties. NARO-NaCRRI Pp34

Papers published/Manuscripts (2009-2014)

Authors	Publication year	Title	Journal details
Mwanga, R.O.M., B. Odongo, C.N. Niringiye, A. Alajo, B. Kigozi, R. Makumbi, E. Lugwana, J.Namakula, I. Mpembe, R. Kapinga, B. Lemaga, J. Nsumba, S. Tumwegamire, and C.G. Yencho	2009.	'NASPOT 7', 'NASPOT 8', 'NASPOT 9 O', 'NASPOT 10 O', and 'Dimbuka-Bukulula' Sweetpotato.	HortScience 44(3):828–832
Stevenson, P.C., Muyinza, H, Hall, D.R., Porter, E.A., Farman, D.I., Talwana, H. and Mwanga, R.O.M.	2009.	Chemical basis for resistance in sweetpotato Ipomoea batatas to the sweetpotato weevil Cylas puncticollis.	Pure and Applied Chemistry, 81, 141-151.

Papers published/Manuscripts

Yada, B., P. Tukamuhabwa, A. Alajo and R. O. M. Mwanga-.	**2010**	**Morphological Characterization of Ugandan Sweetpotato Germplasm**	**Crop Science 50:2364-2371.**
Yada, B., P. Tukamuhabwa, B. Wanjala, D. Kim, R.A. Skilton, A. Alajo, and R.O.M. Mwanga..	2010	Characterization of Ugandan sweetpotato germplasm using fluorescent labelled simple sequence repeat markers.	HortScience 45(2):225-230

Papers published/Manuscripts

Mwanga, R.O.M. C. Niringiye, A. Alajo, B. Kigozi, J. Namakula, and I. Mpembe	2011	'NASPOT 11', a sweetpotato cultivar bred by a participatory plant-breeding approach in Uganda.	HortScience 46(2):317–321. 2011.
Mwanga, R.O.M and Ssemakula, G.	2011	Orange-fleshed sweetpotatoes for food, health and wealth in Uganda.	International Journ. of Agricultural Sustainability. 9 (1): 42-49
Yada B., P. Tukamuhabwa, A. Alajo, & R.O.Mwamga).	2011	Field evaluation of Ugandan sweetpotato germplasm for yield, dry matter and disease resistance.	South African Journ. Of plant and soil. 28(2): 142-146

Papers published/Manuscripts

Sefasi, A. J. Kreuze, M. Ghislain, S. Manrique, A. Kiggundu, G. Ssemakula and S. B. Mukasa	2012	Induction of somatic embryogenesis in recalcitrant sweetpotato (Ipomoea batatas L.) cultivars.	African Journal of Biotechnology 11(94): 16055-16064
Sefasi A., M. Ghislain, A. Kiggundu, G. Ssemakula, R. Rukarwa, and S. B. Mukasa .	2013	Thidiazuron improves adventitious bud formation in recalcitrant sweetpotato.	African Crop Science Journal 21(1):85-95
Rukarwa R.J., Mukasa S.B., and Ssemakula G. .	2013	Evaluation of progenies from crosses between Bt and non-transgenic sweetpotato (Ipomea batatas).	International Journal of Agronomy and Agricultural Research 3(3):28-37

Papers published/Manuscripts

Rukarwa R.J., Prentice K., Ormachea M., Kreuze J.F. , Tovar J., Mukasa S.B., Ssemakula G., Mwanga R.O.M. and Ghislain M.	2013	Evaluation of bioassays for testing Bt sweetpotato events against sweetpotato weevils.	African Crop Science Journal. 21(3): 235-244
Ghislain, M., Tovar, J., Prentice, K., Ormachea, M., Rivera, C., Manrique, S., Kreuze, J., Rukarwa, R., Sefasi, A., Mukasa, S., Ssemakula, G., Wamalwa, L. and Machuka, J.	2013	Weevil Resistant Sweetpotato through Biotechnology.	Acta Hort. (ISHS) 974:91-98
M.O. Anyanga, Harriet Muyinza, Herbert Talwana, David R. Hall, Dudley I. Farman, G. N. Ssemakula, Robert O M Mwanga and Philip C. Stevenson.	2013	Resistance to the weevils, Cylas puncticolis and Cylas brunneus conferred by sweetpotato root surface compounds.	Journal Agricultural and Food Chemistry 61(34): 8141-8147

Papers published/Manuscripts

Rukarwa R. J., S. B. Mukasa, B. Odongo, G. Ssemakula and M. Ghislain	2014	Identification of relevant non-target organisms exposed to weevil-resistant Bt sweetpotato in Uganda.	Biotech. 4, (3): 217-226
Niringiye CS, Ssemakula GN, Namakula J, Kigozi CB, Alajo A, Mpembe I and Mwanga ROM	2014	Evaluation of Promising Sweet Potato Clones in Selected Agro Ecological Zones of Uganda.	Time Journals of Agriculture and Veterinary Sciences 2(3):81-88

15 papers - conference proceedings

- ✓ 15th ISTRC Symposium (2009), Peru -2
- ✓ 11th Symposium of ISTRC-AB, DRC (2010)-2
- ✓ Global Conf. on Entomology, Thailand (2011) -1
- ✓ ACSS Conf. (2011), Mozambique -1
- ✓ 16th ISTRC Symposium (2012) Nigeria -3
- ✓ 12th ISTRC-AB Symposium (2013), Ghana -2
- ✓ APA (2013), Kenya- 4

Staffing

Staff Category	No.	Gender (M/F)	Age <35 / > 35 years
PhD (Plant breeder)	2	F&M	>35 & <35
Msc Agronomist	1	M	>35
PhD Entomologist	1	M	>35
Technicians	6	4F& 2M	>35
Bsc. Biotechnologist (40%)	1	F	<35

Update Other Project Information

Harvest Plus $18,000 – 1 year

Seed systems/Net tunnel -$183,000-3 years

McKnight- Breeding (4years, has ended)

ATAAS/GOU- Variable amounts (50-80million

Ug shillings every year + salaries)

Challenges

- Understaffing in relation to work magnitude
- Under-funding
- Lengthy Procurement Process
- Most biotic constraints have a home in Uganda














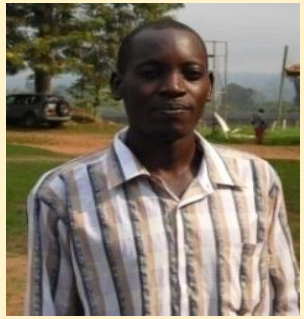


The S/potato team

Thank you!!!