

# Sweetpotato Breeding Activities in East and Central Africa

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# Introduction



## Countries covered:-

1. Kenya
2. Uganda
3. Tanzania
4. Ethiopia
5. Rwanda
6. Burundi

# Key traits bred for



Country	Key trait						
Burundi	High yield	High beta carotene	SPVD Resistance	Alteranaria Resistance	High dry matter	Continuous Storage root formation/ bulking	
Ethiopia	Root yield	Beta-carotene	Dry matter				
Rwanda	Root Yield	Beta-carotene	DMC	Dual-purpose	Processing Quality		
Kenya	Root yield	Dual use	DMC	Beta-carotene	Process ing quality	SPVD resistance	Alternaria Resistance
Tanzania	Pests tolerance	Diseases Resistance	DMC	high yield			
Uganda	SPVD, SPW resistance	Alternaria Blight resistance	Root Yield	Dry matter	pro-vitamin A	Anthocyanins	

# Traits would like to breed for but resources are limited



Burundi	Nutritional qualities (antioxidants)	Weevil		
Ethiopia	SPVD	Weevil	Drought	
Rwanda	Root shape	Anthocyanin	Vines/cooking types	
Kenya	Weevil	Drought	Processing quality	
Tanzania	Early maturing,	weevil	drought	
Uganda	Drought	Herbicide resistance	Processing traits (skinning resistance, starch quality, shapes, storability, oxidation resistance)	Earliness

# Engagement with farmers and consumers



Country	Engagement/Agronomic			
	Participatory on-station (pos)	Participatory on-farm (pof)	pos & pof	
Burundi	No	Yes	No	
Ethiopia	No	Yes	No	
Rwanda	No	Yes	No	
Kenya	No	Yes	No	
Tanzania	Yes	Yes	No	
Uganda	Yes	Yes	Yes	
Organoleptic assessment/Tasting				
	Farmers group	Paired	Trained panel	
Burundi	Yes	No	No	
Ethiopia	Yes	No	No	
Rwanda	Yes		Yes	
Kenya	No	No	No	
Tanzania	Yes	Yes	Yes	
Uganda	Yes	No	Yes	

# Objectives



Objective	Rwanda	Burundi	Ethiopia	Kenya	Tanzania	Uganda
SPVD resistance	Yes	Yes	No	Yes	Yes	Yes
Dry matter content	Yes	Yes	Yes	Yes	Yes	Yes
Weevil resistance	Yes	Yes	YES	Yes	No	Yes
Earliness	No	Yes	Yes	Yes	No	No



# Status of breeding program [observation trial OT); advanced trial (AT); on-farm trial (OFT)



Description / Country	Rwanda	Burundi	Ethiopia	Kenya	Tanzania	Uganda
a) Number of sweetpotato breeders	3	2	5	1	5	3
Staff time (a) (e.g., 1.0; 0.2. 0.5, 0.8)		0.2	1.8	0.2		1.0
b) Number of technicians	3		6	4	8	8
Staff time (b) (e.g., 1.0; 0.2. 0.5, 0.8)		0.3	3.0	1		1.0
Functional screenhouses (number)	4	0.1	1	1	2	3
Year last received botanical seed	2017	2017	2015	2013	2016	2017
Number of seeds received	????	95400	900	500	2,600	1300
Which country or countries sent the seed?		CIP Uganda & Mozambique	Mozambique	Uganda	Tanzania	Mozambique/Burkinafaso
Indicate number of clones from seedling selections from introduced seed in each stage (e.g. OT-456; AT-8; OFT -3)		OT-5086	OT=420 PYT = 210 in 5 categories	OT: 50, PYT; 25 AT; 12 OFT;5	PT 70 AT 12, UT 12, OT 7	1000

# Status of breeding program – Data analysis



Country	Program used for statistical analysis				
Country	Clone Selector	HIDAP	Genestat	R	SAS
Burundi		X		X	
Ethiopia			X		X
Rwanda	Only for planting & seed preparation		X		X
Kenya	X		X		X
Tanzania	X	X			
Uganda		X	X	X	



# Sweetpotato trials/No. of clones planted last season 2017/2018



Trial	Country/No of clones					
	Burundi	Ethiopia	Kenya	Tanzania	Uganda	Rwanda
Crossing block	33	-	0	20	73	12
Observation trial	7,983	1	0	0	1,220	874
Advanced trial	21	5	0	12	23	42
On-farm	0	1	2	7	12	5

# Season (last) 2017/2018



Trial	Country/Analysis					
	Rwanda	Burundi	Ethiopia	Kenya	Tanzania	Uganda
Number of clones/parents in crossing block 2017/2018	12	33	-	-	20	73
<b>Observation (OT)</b> – No. of clones	874	2897	420	0	0	1,220
Preliminary yield (PT)- No. of clones	42	0	-		70	119
<b>Advanced yield (AT)</b>	27	21	60	0	12	23
On-farm		0	9	3	7	12
No. of varieties released 2017	0	3	1	0	0	5
No. of OFSP clones released in 2017	0	2	-	-	0	5
No. of clones <b>earmarked for release</b> during 2018	3	6	-	8	0	2
Number of clones with <b>high potential for release in 2019</b>	2	0	4	3	7	3
No. of clones/varieties for 2017-2019 that have been cleaned up	2	0	6	8	0	0
No. of clones/varieties for 2017-2019 that need to be sent for clean-up		2	4	10	9	8

# Funding source for sweetpotato breeding/Foundation seed activities



Source of funding /amount	Country/Amount					
	Burundi	Ethiopia	Kenya	Uganda	Tanzania	Rwanda
National program (breeding)	US 5 000	x	<b>0</b>	15,000	NIL	<b>\$12000</b>
SASHA-II (Foundation seed)	US 35.706	x	<b>15,000 USD</b>	50,000	CIP	<b>\$ 19,584</b>
Others (Name them)	US 45 000	-	<b>USAID Project</b>	BMGF-PEARL (499,000) GT4SP (1,250,000)	BMGF	-
Stock/Foundation seed available (No. varieties)	1400000 (4 varieties)	4	<b>3</b>	5	5	<b>14</b>
Number of plants	280000	> 3000	<b>2000</b>	2000 cuttings	NIL	-
No. of varieties/clones in tissue culture	3	3	<b>0</b>	5	NIL	<b>14</b>
No. of <b>functional Screenhouses/Net tunnels</b>	1	11	<b>1</b>	<b>3</b>	2	<b>4</b>

# List of projects and papers (published in 2017/2018)



## On-going sweetpotato breeding projects (period, amount of funding, source): Ethiopia

1. National sweetpotato improvement program, 2017-2019, \$28,500
2. SASHA-II, 2015-2019, \$73,000

## Journal /Workshop/ Conference papers

1. **Fekadu Gurmu**, Hussein Shimelis, Mark Laing. 2018. Combining Ability, Heterosis and Heritability of Storage Root Dry Matter, Beta-Carotene and Yield-related Traits in Sweetpotato. HortScience 53(2):167-175.
2. **Fekadu Gurmu**, Hussein Shimelis, Mark Laing. 2017. Correlation and path-coefficient analyses of root yield and related traits among selected sweetpotato genotypes. South African Journal of Plant and Soil, DOI: 10.1080/02571862.2017.1354405.
3. **Fekadu Gurmu**, Hussein Shimelis, Mark Laing. 2017. Genotype-by-Environment Interaction and Stability of Sweetpotato Genotypes for Root Dry Matter,  $\beta$ -carotene and Fresh Root Yield. Open Agriculture (De Gruyter Open) 2:473-485.
4. **Fekadu Gurmu**, Hussein Shimelis, Mark Laing. 2017. Evaluation of candidate orange-fleshed sweetpotato clones for nutritional traits. Acta Agriculturae Scandinavica, Section B - Soil & Plant Science 67(7), 651-659.
5. **Fekadu Gurmu**. 2017. Stability Analysis of Fresh Root Yield of Sweetpotato in Southern Ethiopia using GGE Bi-Plot. International Journal of Pure Agricultural Advances 1(1):1-9.
6. **Fekadu Gurmu** and Shiferaw Mekonen. 2017. Registration of a Newly Released Sweet Potato Variety “Hawassa-09” for Production in Ethiopia. Agrotechnology 6(2):1-3.
7. Shiferaw Mekonen, **Fekadu Gurmu** and Tesfaye Tadesse. 2017. Evaluation of Elite Sweetpotato Genotypes for Resistance to Sweetpotato Virus Disease in Southern Ethiopia. International Journal of Advanced Research 5(7), 77-83.

# List of projects and papers (published in 2017/2018)



**Uganda:** On-going sweetpotato breeding projects (period, amount of funding, source)

- **BMGF-PEARL** Project (2014-2018) USD 499,000 BMGF
- **GT4SP Project** (2014-2018) USD 1,250,000 NCSU-BMGF

Journal /Workshop/ Conference papers.

1. **Anyanga Milton O.**, [Benard Yada](#), [G. C. Yencho](#), [Gorrettie N. Ssemakula](#), [Agnes Alajo](#), [Dudley I. Farman](#), [Robert O. M. Mwanga](#), and [Philip C. Stevenson](#) 2017. Segregation of Hydroxycinnamic Acid Esters Mediating Sweetpotato Weevil Resistance in Storage Roots of Sweetpotato. [Front Plant Sci.](#) 8: 1011

2. **Sefasi Abel**, Marc Ghislain, Andrew Kiggundu, Gorrettie Ssemakula, Runyararo Rukarwa, Robert Mwanga, Jan Kreuze and Settumba Mukasa. 2017. Embryo-like structures and root regeneration induced by 2, 4dichlorophenoxyacetic acid in twenty African sweet potato cultivars. *African Journal of Agricultural Research.* 12(14): 1190 1195

3. **Yada Benard**, Gina Brown-Guedira, Agnes Alajo, Gorrettie N. Ssemakula, Eric Owusu-Mensah, Edward E. Carey, Robert O.M. Mwanga and G. Craig Yencho. 2017. Genetic analysis and association of simple sequence repeat markers with storage root yield, dry matter, starch and  $\beta$ -carotene content in sweetpotato. *Breeding Science Preview* doi:10.1270/jsbbs.16089.

4. **Yada Benard**, Agnes Alajo, Gorrettie N. Ssemakula, Robert O.M. Mwanga, Gina Brown-Guedira, and G. Craig Yencho. 2017. Selection of Simple Sequence Repeat Markers Associated with Inheritance of Sweetpotato Virus Disease Resistance in Sweetpotato. *Crop Science* 57:1-10

5. **Yada Benard**, Agnes Alajo, Gorrettie N. Ssemakula, Gina Brown-Guedira, Milton Anyanga Otema, Philip C. Stevenson, Robert O. M. Mwanga, G. Craig Yencho. 2017. Identification of simple sequence repeat markers for sweetpotato weevil resistance. *Euphytica* 213:129. DOI 10.1007/s10681-017-1917-1

# Journal /Workshop/ Conference papers Cont'd.



6. Ssemakula **Gorrettie**, Babirye Grace, Mirembe Joan, Musa Kpaka, Kiddo Mtunda, Manyong Victor, and Regina Kapinga (2017). Fast-tracking the Access to Improved and Popular sweetpotato Varieties by Small Holder Farmers through School Going Children in Uganda. Paper Presented at the ISTRC-AB conference, Dar es Salaam 5-10/3/2017 pg 318 book of abstracts
7. **Mwanga** R.O.M, R.N. Makumbi, M. Andrade, G.S. Makunde, J. Ricardo, J. Low, J. Kreuze, W.J. Grüneberg, G.N. Ssemakula, B. Yada, K. Adofo, E. Carey 2017. Rationale for sub-regional sweetpotato breeding in sub-Saharan Africa. Paper Presented at the ISTRC-AB conference, Dar es Salaam 5-10/3/2017 pg 137 book of abstracts
8. **Kiddo Mtunda**, Everina Lukonge, Gorrettie Ssemakula, Haji Saleh, Gration Rwegasira, Mary Yongolo, Stephen Merumba, and Geraldina Mushema (2017). Novel delivery strategies for improved sweetpotato varieties: Experience from the fast track the improved varieties. Paper Presented at the ISTRC-AB conference, Dar es Salaam 5-10/3/2017. Book of abstracts pg 309
9. **Kpaka** M.H., Manyong V., Mtunda K. Ssemakula G., Mirembe J. 2017. A phenotypic Approach to get better estimates for adoption rates of improved sweetpotato varieties, and predicting factors that influence farmer decision to adopt and intensify adoption: A logit and Tobit Model. Paper Presented at the ISTRC-AB conference, Dar es Salaam 5-10/3/2017. Book of abstracts pg 346



# List of projects and papers ( published in 2017/2018/



**Rwanda:** On-going sweetpotato breeding projects (period, amount of funding, source) **NIL**

Journal /Workshop/ Conference papers/ **Thesis.**

1. Damien **Shumbusha**, Hussein Shimelis and Mark Laing. 2018. Breeding Dual-purpose Sweetpotato [*Ipomoea batatas* (L.) Lam.] Varieties in Rwanda. PhD Thesis, University of KwaZulu-Natal, South Africa.

## **TANZANIA**

List of projects and papers (published in 2017/2018; **NIL**

On-going sweetpotato breeding projects (period, amount of funding, source): **SASHA II-CIP**  
USD 4,500: RF TSHS:927,450, AYT, OT AND UYT-GOT.

Journal /Workshop/ Conference papers.

**Rwanda:** Challenges Faced and Your Thoughts for Addressing Those Challenges

1. proposal submitted to AGRA for funding/ But still pending
2. Joint proposal with Rice program submitted to IDRC-France



# Ethiopia: Challenges Faced and Your Thoughts for Addressing Those Challenges



Problems	Solutions
<ul style="list-style-type: none"><li>• Drought, affecting trials and seed production</li></ul>	<ul style="list-style-type: none"><li>• Install and maintain irrigation systems</li></ul>
<ul style="list-style-type: none"><li>• Shortage of human capacity at NARS programs</li></ul>	<ul style="list-style-type: none"><li>• Long term and short term training / Hire breeders</li><li>• Service hub for molecular works</li></ul>
<ul style="list-style-type: none"><li>• Low funding</li></ul>	<ul style="list-style-type: none"><li>• Seek grants and advocate for more government funding</li></ul>
<ul style="list-style-type: none"><li>• Emerging non tradition pests: Fall army worm, e.g Uganda</li></ul>	<ul style="list-style-type: none"><li>• Surveillance, early warning, and Integrated Pest management strategies</li></ul>

# Two Photographs with captions showing achievements during past year- Uganda



**Sweetpotato root tasting of advanced lines during sweetpotato field day at AbiZARDI**



**Sweetpotato Breeding Trials at NaCRRI, Uganda: 2017**





# Two Photographs with captions showing achievements during past year : Ethiopia



**Planting of demo plots, Dilla, August 2017, Photo credit: Fekadu Gurmu**



**Harvesting of demo plots Dilla, August ,2017, Photo credit: Fekadu Gurmu**





# Cold tolerant, dual purpose national performance trials - Kenya

**Dual purpose, cold tolerant  
NPT trials**



**Newly released Silklow 6 :  
Orange fleshed**





## Two Photographs with captions showing achievements during past year, Tanzania



**Pre-basic seeds at ARI-Ukiriguru**



# Two Photographs with captions showing achievements during past year: Rwanda



Pic 1: Visit of Dr. Barbara Wells, DG CIP to the crossing block at RAB, Rubona, Rwanda.



Pic 2: One of the novel dual-purpose progenies selected and recommended for advanced clonal evaluation.