Sweetpotato Breeding Activities in West Africa

SWEETPOTATO ACTION FOR SECURITY AND HEALTH IN AFRICA

Introduction

- **Sub-region covered-**
  West Africa

- **Countries covered –**
  Burkina Faso, Cote d'Ivoire, Ghana, Nigeria

Key traits bred for

Country	Key trait(s)					
Burkina Faso	Yield	Beta-carotene	Dry matter	Earliness		
Cote d'Ivoire	Yield	Dry mater	Beta-carotene			
Ghana	Drought,	earliness (climate smart),	weevil resistance	Beta-carotene low sweetness	virus resistance	High yield, dry matter and starch
Nigeria	High yield,	good root shape	high dry matter	SPVD resistance provit A	drought tolerance	

Traits would like to breed for but resources are limited

Burkina Faso	Drought	Earliness	SPVD	Weevil	Storage ability	Root shape
Cote d'Ivoire	Drought	Earliness	Weevil			
Ghana	earliness (climate smart),	Drought, high starch				
Nigeria	Drought tolerance	Storability (longer shelf-life) of fresh roots				

Engagement with farmers and consumers

Country	Engagement/Agronomic			
	Participatory on-station (pos)	Participatory on-farm (pof)	pos & pof	
Burkina Faso	No	Yes	No	
Cote d'Ivoire	No	Yes	No	
Ghana	No	Yes		
Nigeria	No	Yes	No	
Organoleptic assessment/Tasting				
	Farmers group	Paired	Trained panel	
Burkina Faso	Yes	Yes	No	
Cote d'Ivoire	Yes		No	
Ghana	Yes	Yes	Yes	
Nigeria	Yes	No	No	

Objectives

Objective	Burkina Faso	Cote d'Ivoire	Ghana	Nigeria
SPVD resistance	Yes	No	Yes	Yes
Dry matter content	Yes	Yes	Yes	Yes
Weevil resistance	Yes	No	Yes	Yes
Earliness	Yes	No	Yes	No

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

Description	Country/data			
	Burkina Faso	Cote d'Ivoire	Ghana	Nigeria
a) Number of sweetpotato breeders	2		2(SARI) 2 (CRI)	2
Staff time (a) (e.g., 1.0; 0.2. 0.5, 0.8)	0.8	1	1.0/0.5 1.0 / 0.2	1.0
b) Number of technicians	5		1(SARI), 1(CRI)	1
Staff time (b) (e.g., 1.0; 0.2. 0.5, 0.8)	0.7	2	1.0 1.0	1.0
Functional screenhouses (number)	4	0	2 (SARI) 7 (CIP /CRI)	1
Year last received botanical seed	2017	2017	2016(SARI) 2014 (CRI)	2016
Number of seeds received	3000	3000	1,340 5000	2,791
Which country or countries sent the seed?	Mozambique	Mozambique	Mozambique	Mozambique
Indicate number of clones from seedling	OT 500 PT-118	OT-2000 PT-376	Nil	OT - 500

Status of breeding program – Data analysis

Country	Program used for statistical analysis					
Country	CloneSelector	HIDAP	Genstat	R	SAS	
Burkina Faso	Yes		Yes		Yes	
Cote d'Ivoire	Yes				Yes	
Ghana		Yes	Yes	Yes		
Nigeria					Yes	

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

Trial	Country/No of clones			
	Burkina Faso	Cote d'Ivoire	Ghana	Nigeria
Crossing block	16	0	55	0
Observation trial	0	1352	CRI 4/187 SARI 2/172	1
Advanced trial		19	15	0
On-farm	8	5	11	4

Season (last) 2017/2018

Trial	Country/Analysis			
	Burkina Faso	Cote d'Ivoire	Ghana	Nigeria
Number of clones/parents in crossing block 2017/2018	16		7(CRI) 48(CIP)	0
Observation (OT) – No. of clones	0	1352	459	2,791
Preliminary yield (PT) - No. of clones	118		37	0
Advanced yield (AT)		19	15	0
On-farm	8	5	11	6
No. of varieties released 2017		0	3 (SARI) 2(CRI)	0
No. of OFSP clones released in 2017		0	0/1(SARI)	0
No. of clones earmarked for release during 2018	5 subm	4	3/7(SARI)	2
Number of clones with high potential for release in 2019			12/9(SARI) 4 (CRI)	0
No. of clones/varieties for 2017-2019 that have been cleaned up	4		15	8
No. of clones/varieties for 2017-2019 that need to be sent for clean-up	10	10	10	after 2018 trials

BURKINA FASO: Sweetpotato clones in the pipeline for official release

Country/Clone name/code	HEERE	NOOMA	KBOr-3	KBOr-4	KBPourpre-1
Breeding method/traditional breeding scheme/accelerated b. s. (TBS/ ABS)	ABS	ABS	ABS	ABS	ABS
Yield (t/ha)	20-25	15-20	15-20	15-20	25-30
Flesh color: orange/white/yellow/purple/o/w/y/p	Orange	Orange	Light orange	Orange	Purple
Skin color	Orange	Orange	Pink	Cream	Purple
Shape of root	Ovate	Ovate	Oblong	Elliptic	Elliptic
ß-carotene (mg/100g fwb)	32.12	24.70	NA	18.42	0.00
Dry matter (%)	29	27	28	26	31
Maturity period: Early (E) (about 4 months), late (L) about 5 or more months	E	E	E	E	E
For food (FO) Feed (FE), Dual purpose (DU)	FO	FO	FO	FO	FO
Resistant [R])/susceptible (S) to SPVD	R	Moderate	S	S	Moderate
Resistant [R)/ susceptible (S) to Alternaria	NA	NA	NA	NA	NA
Origin	INERA	INERA	INERA	Tusk Univ	Tusk. Univ
Pedigree	BF59xCIP199062.1	BF59xCIP199062.1	BF13xCIP199062.1	unknown	Unknown
Availability of planting materials:VS(very small quantities), easy to find (ef), abundant/very easy to find (A)	A	EF	VS	VS	A
Anticipated year of release	2018	2018	2018	2018	2018
Remarks [E.g. Drought tolerance, weevil resistance]	Good tolerance to drought	Good tolerance to drought	Good resistance to weevil	Very nice shape and smooth skin	Good tolerance to drought

CÔTE D'IVOIRE: Sweetpotato clones in the pipeline for official release

Country/Clone name/code	Aleda Manda	Kra1	Fatoni2	Kra2	
Breeding method/traditional breeding scheme/accelerated b. s. (TBS/ ABS)	TBS	TBS	TBS	TBS	
Yield (t/ha)	30	22	20	20	
Flesh color: orange/white/yellow/purple/o/w/y/p	Yellow	white	Yellow	Yellow	
Skin color	Yellow	Pink	Pink	Pink	
Shape of root					
ß-carotene (mg/100g fwb)					
Dry matter (%)	32	37	40	40	
Maturity period: Early (E) (about 4 months), late (L) about 5 or more months	E	E	E	E	
For food (FO) Feed (FE), Dual purpose (DU)	FO	FO	FO	FO	
Resistant [R])/susceptible (S) to SPVD	R	S	R	R	
Resistant [R)/ susceptible (S) to Alternaria					
Origin	Côte d'Ivoire	Côte d'Ivoire	Côte d'Ivoire	Côte d'Ivoire	
Pedigree	Unknown	Unknown	Unknown	Unknown	
Availability of planting materials:VS(very small quantities), easy to find (ef), abundant/very easy to find (A)	EF	EF	A	EF	
Anticipated year of release	2018	2018	2018	2018	
Remarks [E.g. Drought tolerance, weevil resistance]					

NIGERIA: Sweetpotato clones in the pipeline for official release

Country/Clone name/code	SOLO-GOLD	NAMANGA
Breeding method/traditional breeding scheme/accelerated b. s. (TBS/ ABS)	ABS	TBS
Yield (t/ha)	25.61	22.85
Flesh color: orange/white/yellow/purple/o/w/y/p	Orange	Orange
Skin color	Purple red	Cream
Shape of root	Obovate	Elliptic
ß-carotene (mg/100g fwb)	15.28	11.27
Dry matter (%)	33	31
Maturity period: Early (E) (about 4 months), late (L) about 5 or more months	E	E
For food (FO) Feed (FE), Dual purpose (DU)	FO	FO
Resistant [R])/susceptible (S) to SPVD	R	R
Resistant [R)/ susceptible (S) to Alternaria	n.a	n.a
Origin	NRCRI, Umudike	CIP-Mozambigue
Pedigree		W 119 X OP
Availability of planting materials:VS(very small quantities), easy to find (ef), abundant/very easy to find (A)	VS	VS
Anticipated year of release	2018	2018
Remarks [E.g. Drought tolerance, weevil resistance]	High dry matter, SPVD resistant, high beta-carotene, broadly adapted	Good dry matter, SPVD resistant, high beta-carotene, broadly adapted

Funding source for sweetpotato breeding/Foundation seed activities

Source of funding /amount	Country/Amount			
	Burkina Faso	Cote d'Ivoire	Ghana	Nigeria
National program (breeding)		0	SASHA	Nill
SASHA-II (Foundation seed)	SASHA-II	0	SASHA-II	SASHA II
Others (Name them):			SASHA	None
Stock/Foundation seed available (No. varieties)	72000 (4 varieties)		14	4060 from 2 varieties
Number of plants	≈9000		1000s	1360
No. of varieties/clones in tissue culture	3		>60	0
No. of functional screenhouses	4		7 (CIP/CRI) 2 (SARI)	3

List of projects and papers (published in 2017/2018 Burkina Faso

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

0

Journal /Workshop/ Conference papers.

1

1. Ali GARANE, **Koussao SOME**, Souleymane KOUSSOUBE, Mamoudou TRAORE et Mahamadou SAWADOGO, 2017. Flore adventice de la patate douce (Ipomea patatas (L) Lam) du centre du Burkina Faso : structure et fréquence des espèces. *Afrique Science 13(4) (2017) 381 – 399*

List of projects and papers (published in 2017/2018 Côte d'Ivoire

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

0

Journal /Workshop/ Conference papers.

1. Participatory selection of orange-fleshed sweetpotato varieties in north and north-east Côte d'Ivoire, *Dibi K.E.B., Essis B.S., Nzué B., Kouakou A.M., Zohouri G.P., Assouan A.B. and Mourik T.M., 2017. De Gruyter - Open Agriculture, 2017; 2: 83–90, https://www.degruyter.com*

2. Participation to the 13th International Symposium of the International Society for Tropical Root Crops - Africa Banch (ISTRC-AB), from 5-10 March 2017 at White Sands Hotel, Dar Es Salaam, Tanzania

3. Participation to the International course on root and tuber crops entrepreneurship development, organized by CORAF from 17 to 30 july 2017, CSIR-Crops Research Institute (CRI), Kumasi-Ghana.

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

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

Journal /Workshop/ Conference papers.

1. Charles Tortoe, Papa Toah Akonor, Kristine Koch, Carolin Menzel & **Kwadwo Adofo** (2017): Amylose and amylopectin molecular fractions and chain length distribution of amylopectin in 12 varieties of Ghanaian sweet potato (Ipomoea batatas) flours, ***International Journal of Food Properties***,

2. E. N. Amengor, A. Adu Appiah, B. Frimpong Nsiah, J. Osei-Adu and **K. Adofo (2017)**. Adoption potential of improved sweetpotato varieties in Ghana. ***Agricultural and Food Science Journal of Ghana***. Volume 10(1). August 2017.

3. Tortoe, C., Akonor, P. T., Koch, K., Menzel, C. and **Adofo, K.** (2017). Physicochemical and functional properties of flour from twelve varieties of Ghanaian sweetpotato. ***International Food Research Journal*** 24(6): 2549-2556

4. Médétissi Adoma,∗, David D. Wilson a,b, Ken O. Fening , Anani Y. Bruce and **Kwadwo Adofo (2018)** .Bionomics of the sweet potato weevil, *Cylas puncticollis* (Coleoptera: Brentidae) on four different sweet potato varieties in sub-Saharan Africa. ***Journal of Agriculture and Rural Development in the Tropics and Subtropics*** Vol. 119 No. 1 (2018) 55–63

5. Marian Dorcas Quain*, **Kwadwo Adofo**, David Appiah-Kubi, Ruth Naa Prempeh, John Asafu-Agyei, Belinda Akomeah and Harrison Dapaah (2018) Use of expressed sequence tags-derived simple sequence repeat (SSR) markers for population studies of released and elite sweet potato. ***International Journal of Genetics and Molecular*** **Biology** Vol. 10(2), pp. 14-25

List of projects and papers (published in 2017/2018, Nigeria

Development of random drought tolerant OFSP genotypes with good agronomic, food and nutritional qualities for Nigerian smallholder farmers.

Fund and source of fund: None

Journal /Workshop/ Conference papers.

1. Adesina B.A., Abdulrasheed, M.D., Okoye, A.C., Ekah, E.O., Anedo, E.O. and **Afuape, S.** (2017). Farmers' willingness to pay for quality orange-fleshed sweetpotato (OFSP) vines in north central Nigeria: A case of Benue and Nasarawa States. Nigerian Agricultural Journal, 48(1): 110-121.
2. Amadi, C.O., Njoku, D.N., Gore, M., Egesi, C.N., **Afuape, S.** and Olojede, O.A. (2017). Reducing post-harvest physiological deterioration in cassava breeding by National Root Crops Research Institute Umudike. Nigerian Agricultural Journal, 48(1): 132-141.
3. Adesina B.A., Okoye, A.C., Ekah, E.O., Onyenobi, V., Abimbola, O.O., Ikama, K., Ogunola, O.E. and **Afuape, S.O.** (2017). Cost and benefit analysis of dry season production of orange-fleshed sweetpotato vines and roots in NRCRI, Umudike. Proceedings of the 51st Annual Conference of Agricultural Society of Nigeria (ASN) (In press) **(Acceptance letter attached)**
4. Korieocha, D.S., Udom, G.N., Njoku, J.C., **Afuape, S.O.**, Ogbonna, M.C. and Eluagu, C.J. (2017). Effect of varying rates of paraquat, atrazine metolachlor in sweetpotato production at Umudike, southeastern Nigeria. Proceedings of the National Annual Conference of Crop Science Society of Nigeria (CSSN), pp 459- 462

Challenges Faced and Your Thoughts for Addressing Those Challenges, Burkina Faso

SASHA
Sweetpotato Action for Security and Health in Africa

Challenges

- Funding for breeding no more easily available
- Limit number of staff for breeding

Solution

- Institutional support expected but not yet seen
- Writing and submitting proposals
- Training one more breeder (PhD)

Challenges Faced and Your Thoughts for Addressing Those Challenges, Ghana

- Funding challenges in carrying out independent breeding programme in CSIR-SARI.

- Funds for Research Activities. Development of concept notes and proposals for sourcing funds (CSIR-CRI)

- Lobbying for Collaborative work (CSIR-CRI)

Challenges Faced and Your Thoughts for Addressing Those Challenges, Nigeria

SASHA
Sweetpotato Action for Security and Health in Africa

Challenges

- Acute lack of funding from the Institute, especially when no external funding support is available.
- Lack of screenhouse for breeding activities alone as breeding lines and elite germplasm cannot usually co-exist with basic seed materials in the same space to prevent virus infection.

Probable solutions

- The breeder should strive to attract external funding for his breeding activities,
- Allowing the breeder who developed new varieties and breeder's seed to be in charge of the seed system in all countries may help in getting small funds to cater for the breeding program
- Sub-regional platforms can also jointly develop proposals with NARs for funding, and may also help financially struggling NAR breeding programs with funds when possible

Two Photographs with captions showing achievements during past year, Burkina Faso

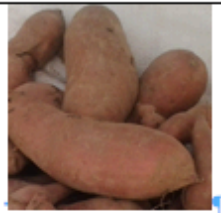
TRAORE Abou, from Samorogouan, the biggest OFSP farmers in Burkina Faso growing OFSP variety HERE (BF59xCIP-4) and the type of tracks that buy OFSP from the field (Photo, SOME K, October 2017)

Two Photographs with captions showing achievements during past year, Côte d'Ivoire

SASHA
Sweetpotato Action for Security and Health in Africa

Variety Releases

CSIR-CRI Aug, 2017 CSIR-SARI May 2018

Root characteristics	Genotype		
	Nanugungungu	Purple	Obari
Storage root shape	 Long oblong	 Obovate	 Oblong
Storage root skin colour	 Brownish orange	 Purple-red	 Pale yellow
Storage root flesh colour	 Intermediate orange	 Strongly pigmented with anthocyanins	 White
Storage root DM	26 - 29.3%	32.8 - 35%	34.3 - 38%

Two Photographs with captions showing achievements during past year, Nigeria

Young leaves and flower of Solo-Gold

Intact roots of Solo-Gold

Root flesh of Solo-Gold

Sample	Starch (%)	Sugar (%)	Dry matter content (%)	Beta Carotene (mg/100g)
Solo-Light	23.19	2.70	33.90	15.09
Solo-Gold	**23.25**	**2.72**	**33.03**	**15.28**
F1	22.97	2.64	33.58	15.25
F2	23.23	2.72	33.03	15.08
Irene	23.21	2.84	33.04	13.26
Local	23.60	2.80	32.51	1.68
MD	**22.98**	**2.79**	**28.74**	**13.26**
Namanga	**23.88**	**2.84**	**31.51**	**11.27**