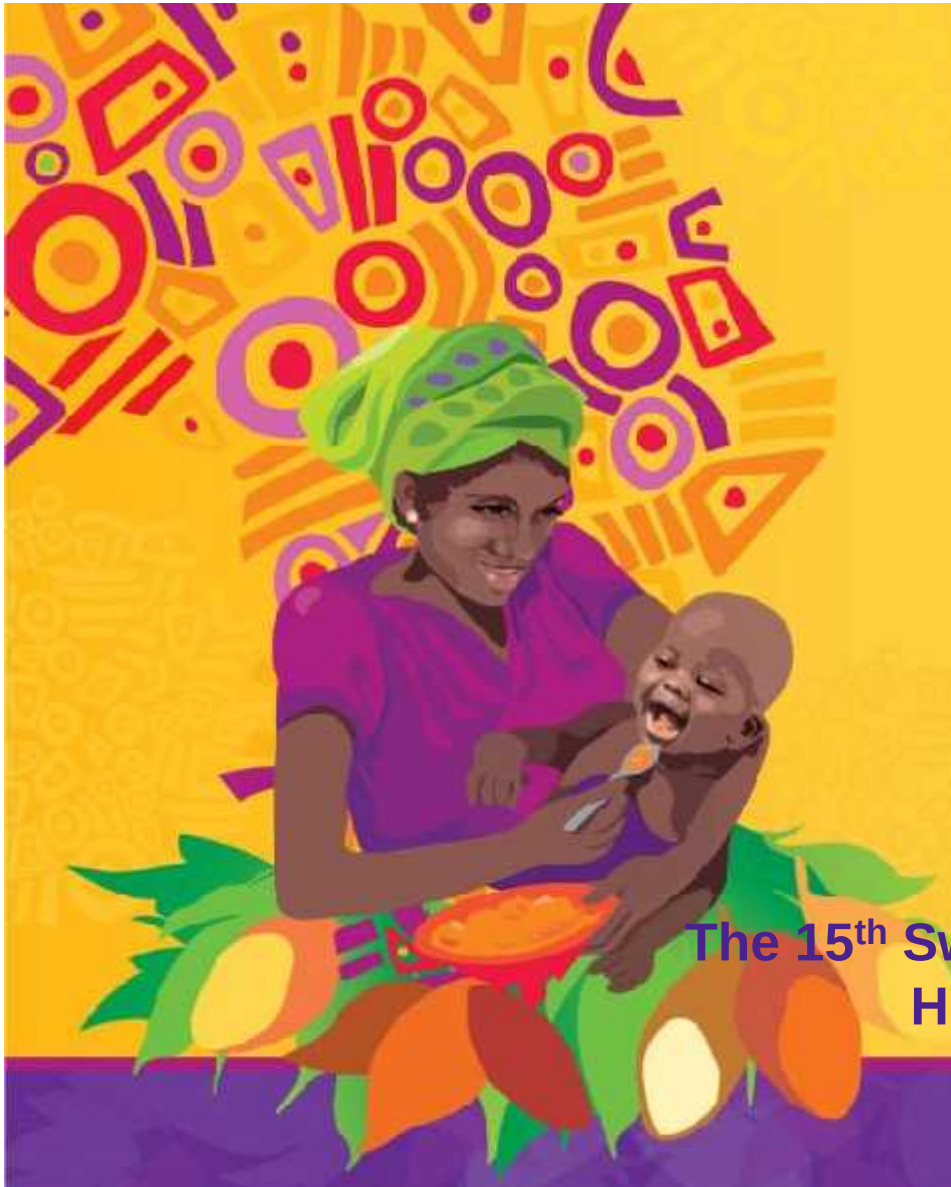

Sweetpotato Breeding at the Southern Africa Sweetpotato Support Platform (SSP)

By

Andrade, Alvaro, Ricardo, Makunde, Low, Eyzaguirre & Gruneberg

The 15th Sweetpotato Breeders Meeting, Colline Hotel, Uganda, June 2-5, 2015

Objectives: Breeding & Germplasm Management in Southern Africa

SASHA
Sweetpotato Action for Security and Health in Africa

Breeding:

- **Generate drought resistance, OFSP that combine different quality characteristics with significant Improvements in yielding ability**

Germplasm Management:

- **Maintain good Quality material, Establish community based seed systems for good quality seed dissemination and develop & test strategies for the multiplication and dissemination of varieties**

Research Support Facilities

- 16 Screen Houses
- 1 Kitchen Lab
- 1 Quality Lab (NIRS Machine)
- 1 Tissue Culture Lab with IIAM
- Equipment LAM, IGA, Porometer
- Research Stations
- Farmer's Field








Milestone SASHA II

- **1.1.1.** Studies demonstrating that can achieve significant genetic gain **(2% per year in yield)** in 2 years in early generations and 4 years for selected varieties,

- **1.3.1.** At least **150 thousand seeds** with drought tolerance genes disseminated to at least 10 NARS partners in SSA and SWCA,

- **1.3.3.** **Hybrid progeny exhibiting yield jump of 10 to 20%** in hybrids from populations with drought tolerant & enhanced efficiency for drought tolerance breeding,

- **1.3.4.** **Clones with 200%RDA for young children** of pro-Vitamin A, 25% RDA of iron and 35% RDA of zinc under high intakes.

1.1.1. Studies Demonstrating that can Achieve Significant Genetic Gain (2% per year in yield) in 2 Years in Early Generations and 4 years for Selected Varieties

This Activities started in 2012 by establishing two crossing blocks Goal to develop clones with population means:

- > 8 t /ha; > 26% DM
- > 59% starch; >100 ppm beta-carotene
- >18 ppm Iron; >9 ppm, Zinc
- Variety with traits vine survival and weevil avoidance.

- Seeds were harvested. Series of trials planted **after** the identification/selection and release of 15 clones in 2011, all under ABS.
- .

1.1.1. (CONT.)

- From 2012-2014, **72 Advanced** clones were identified for more testing.
- In 2014, **4 multi-location** trials planted (Map, Chokwe, Gurue & Lichinga)

- The 72 clones divided in 3 categories (25 PP, 20 dual purpose, 27 OF)
- **On-farm trials** were evaluated to assess varietal performance under farmer conditions and acceptance levels in Mozambique

Data for multi-location shows significant differences for total root yield vine yield, DM, HI and nutrient content (Beta- carotene, Iron and Zinc) among clones in the: OF, PF and dual purpose multi-locational trials

- 9 clones were identified for release. (i) three purple fleshed (ii) three dual purpose, & (iii) three are OF

Characteristics of 9 New Clones Identified for Release

Name	RYLD	V YLD	HI	DM	BC	Fe	Zn	Flesh color
	t/ha		%		mg/100g DW			-
MUSG11049-7	17.5	18.5	46	27.9	PF	1.5	0.98	P
MUSG11016-6	17.8	30.9	32	36.2	PF	1.3	1.2	P
MGSG 11016-1	29.0	23.5	53	30.1	PF	1.5	1.34	P
Mean	21.4	24.3	42	31.4		1.4	1.2	
MCKSG08020-6	16.6	17.0	49	24.6	17.2	2.1	1.5	O
MUSG11016-16	17.2	12.3	59	31.0	36.3	1.8	1.4	O
MUSG11016-12	14.4	28.9	33	36.6	33.5	1.6	1.4	O
Mean	16.1	19.4	47	30.7	29.0	1.9	1.5	
Uejumula_U07-13	17.7	20.5	45	29.4	14.6	1.9	1.3	O
MUSGP0646-126	18.5	23.3	43	30.0	27.6	1.7	1.2	O
MUSG11022-11	18.1	24.7	39	25.6	19.0	1.6	1.1	O
Mean	18.1	22.8	42	28.3	20.4	1.8	1.2	-
Overall Mean	18.5	22.2	44.3	30.2	24.7	1.7	1.3	-

Number of farmers who participated in the evaluation of cooked leaves and root taste

Location		**Gurue**	**Macia**	**Ili**	**Marrac**	Total
Gender	Male	36	35	36	20	127
	Female	36	35	36	19	126
Total		**72**	**70**	**72**	**39**	**253**

Total Root Yield and Vine Yield (t/ha) Attained at Four Different Locations in Mozambique, OFT 2014

Clone name	Macia		Gurue		Ili		Marrac		**Mean**
	RY	VY	RY	VY	RY	VY	RY	VY	RY
MGSG11016-1	7.5	4.2	17.6	15.3	22.8	8.2	7.8	16.0	**13.9**
MUSG11016-6	2.1	13.8	19.7	16.2	18.1	8.2	6.3	13.0	**11.5**
MUSG11049-7	5.3	11.0	17.3	12.5	18.6	15.2	10.0	15.1	**12.8**
Grand total	**14.9**	**29.0**	**54.6**	**44.0**	**59.5**	**31.6**	**24.1**	**44.1**	

COMPARISON OF RELEASES

Main attributes

Statistic	Total Yield (t/ha)			Betacarotene (mg/100 DW)			Dry Matter Content (%)		
	G1	G2	G3	G1*	G2	G3	G1	G2	G3
Average	14.7	20.3	18.5	-	21.3	24.8	23.5	27.6	30.2
Min.	2.5	14.9	11.4	-	5.9	13.8	17.2	24.8	21
Max.	29.3	27.1	28	-	38.4	68.2	27.5	32.8	34.4

Other quality attributes

Statistic	Starch (%)			Iron (Fe) (mg/100gDW)			Zinc (Zn) (mg/100gDW)		
	G1*	G2	G3	G1	G2	G3	G1	G2	G3
Average	-	52.3	54.2	-	1.7	1.7	-	1.4	1.3
Min.	-	59.9	47.2	-	1.6	1.5	-	1.1	1.0
Max.	-	68.3	69.4	-	2.1	2.33	-	1.5	1.65

1.1.1 (CONT.)

Results of trials analyzed in the laboratory from June 2014 to December 2014

- **Means for iron and zinc** were slightly above 2.0 and 1.1 mg/100g DW respectively.
- **Means for beta-carotene** ranged between 30 and 41 mg/100g DW for populations developed at Gurue.
- **DM ranged between** 22 and 40 % in the same populations.

Vine survival and drought tolerance studies planted to understand mechanisms governing drought tolerance and the vine survival trait.

Nutrient Results from the Quality Laboratory from June to December 2014 Samples from Gurue

Overall Mean	YLD	DM	BCNIRS	Protein	Fe	Zn
	t/ha	%	mg/100 g DW	%	mg/100 g DW	mg/100 g DW
AYT 13	13.5	23.9	31.3	4.4	2.1	1.4
AYT 14	11.9	24.5	39.8	4.8	2.3	1.5
AYT 15	14.1	27.0	32.5	3.7	2.1	1.2
AYT 16	13.1	27.2	38.9	4.3	2.4	1.4
AYT 17	13.8	23.2	36.9	3.2	2.3	1.3
AYT 28	13.0	28.0	34.8	6.4	2.2	1.5
AYT 27	21.2	26.8	41.0	3.6	2.3	1.3

Nutritional Data for Trials Carried out at Umbeluzi 2014

	Total Root YLD	DM	BCNIRS	Protein	Fe	Zn
	t/ha	%	mg/100 g DW	%	mg/100 g DW	mg/100 g DW
Overall mean AYT 28	7.4	29.1	38.0	4.1	1.9	1.2
Overall mean AYT 24		24.4	27.7	3.4	1.9	1.2
Overall mean AYT 24		25.8	36.2	5.3	2.6	1.6
Overall mean AYT 68		30.2	24.9	3.7	1.6	0.99

On-station Trials (Harvested Trials)

- **MT – comprised of 19** elite clones planted at Umbeluzi, Chokwe and Chibuto
- **MT –** 2 trials harvested in Gurue
- **AYT** – 6 trials harvested in Gurue
- **PYT** - 109 clones under irrigated conditions at Umbeluzi, 2 replications – harvested 20 February 2015
- **PYT** - 377 clones under irrigated conditions at Umbeluzi, 2 replications – harvested 27 May 2015
- **PYT** – with 73 white fleshed clones evaluated at Umbeluzi,
- **PYT** with 102 white and Orange fleshed clones evaluated at Chokwe

Breeding Progress: Results of Top Eight Clones from Populations from Umbeluzi

Name	DM	BC(NIRS)	Protein	Fe	Zn	Starch	Fructuse	Glucose	Sucrose
	%	mg/100 g DW	%	mg/100 g DW	mg/100 g DW	%	%	%	%
Jewel-27	26,1	30,6	4,0	2,3	1,32	57,98	2,46	3,64	13,18
Jewel-41	29,5	28,3	3,0	2,0	1,15	63,81	2,39	3,75	12,11
W250-25-5	26,5	31,3	4,6	2,3	1,34	57,73	2,33	3,86	13,60
Jewel-52	28,4	30,2	3,0	2,1	1,20	62,97	1,44	2,49	14,04
Maphuta-3	33,8	25,9	3,2	2,1	1,15	65,62	1,49	3,33	14,55
Jewel-80	27,1	32,7	3,5	2,2	1,17	56,46	4,42	6,49	11,82
MGCL01-17	29,7	31,0	3,2	2,1	1,10	57,86	2,37	3,26	15,23
Ejumula-8	29,8	30,3	3,6	2,1	1,10	59,91	2,51	3,81	13,04

On-going Trials

- **MT – with 12 elite** clones (white and yellow fleshed) under further testing (2015)
- **MT – 2 trials at Gurue**
- **AYT – 27** clones (date of planting: 17 February 2015; two treatments – irrigated and drought stress. Each treatment has 2 replications).
- **AYT – 37** clones (date of planting: 15 May 2015: two treatments – irrigated and drought stress. Each treatment has 2 replications).
- **AYT – 3 different trials** with **27, 20** (mixture of white and yellow fleshed) and **26 OFSP** under evaluation at Chokwe, Chibuto and Umbeluzi (2015)
- **AYT** – 7 trials at Gurue
- **PYT** – 1, 209 clones (OF & PF) at Gurue

On-Going Trials

OT – two trials, 335 orange fleshed clones

and the other trial with 123 mixed white and yellow clones are under evaluation at (Chokwe 2015)

OT Umbeluzi **1541** CC

OT Gurue **1411**

24 On-farm trials were established in Southern Mozambique (Marracuene, Manhica, Macia and Chokwe)

- 9 clones (5 white and 4 yellow fleshed) are under evaluation

On-Going Trials

Drought tolerance trial (date of planting: 25 March 2015)

- 54 clones ranging from landrace, elite clones and released varieties, Two treatments, irrigated and drought stress

Heritability for vine survival trial

- 36 clones (ranging from elite clones, released varieties and landrace from Mozambique)

- **Objective:**To estimate heritability of vine survival in a collection of genotypes at three sites.

Preliminary results Vine Survival

- **To estimate survival of vines over a 12 month period**
- 3 trials harvested at 5, 8, and over 12 MAP (after next rain season)

- **Locations:** Umbeluzi, Chokwe and Gurue Research Stations
- **Genotypes** evaluated: mixed sets of 80 clones; Design: RCB with one replication
- Date of planting: Varied. Gurue planted from December o January, Umbeluzi & Chokwe planted in April

Traits were measured

- Established plants, all 3 trials
- Plant vigor a month before harvesting (all trials)
- Vine and root yield (t/ha) in trials 1 and 2.
- **Number of roots that sprouted (trial 3)**
-

Resisto (far left) Compared to two other Clones that had some Surviving Vines at 11 MAP

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Combined data for Number of Sprouting Roots and Vine Yield for Trials with 16 Clones at Umbeluzi and Chokwe

Genotype	NRB	VY
MUSGU0702-17	6.0	9.6
MUSGU0703-6	3.5	3.75
MUSGU0703-12	10.0	3.25
MUSGU0703-15	6.0	2.05
MUSGU0703-17	6.5	4.0
MUSGU0703-22	6.5	5.0
MUSGU0703-29	23.0	6.5
MUSGU0703-30	4.0	2.6
MUSGU0703-37	9.0	5.25
MUSG0704-8	14.5	6.5
MUSGU0704-16	6.0	4.75
MUSGU0704-27	5.5	7.25
MUSGU0704-44	3.0	1.45
MUSGU0705-16	14.0	3.5
MUSGU0705-35	6.0	7.25
MUSGU0706-1	9.5	4.5
Mean	**8.31**	**4.82**
Lsd (5%)	**9.66**	**6.81**

1.3.1. At least 150 Thousand Seeds with Drought Tolerance Genes Disseminated to at Least 10 NARS Partners in SSA and SWCA

- 2 **CB** established in January 2014 at Umbeluzi and Gurue
- Umbeluzi **60 F and 8 M**. Five male parents from the drought tolerant OFSP varieties released
- Gurue, **50 F and 6 M**, Tio Joe as one of the male parents.
- Manual crossing beween May and July

Harvesting commenced in June until September 2014.

- A total of **34 929** seeds were distributed to 7 national programs **Gurue-** Planted 4792 CC and 6 140 polycross, **Chokwe-** 4880 polycrosses, and **Umbeluzi** 1541 CC
- **222 482** polycross (> 111 families) in storage & 45 536 controlled cross seeds (>313 families) also for share

2 **Crossing block planted in Janury 2015** and Controlled crosses began: Early May 2015 at Umbeluzi and Mid-April 2015 at Gurue

Seed vines dissemination linked with TC, Quality Lab and Capacity Building

- **31 089 kg** were disseminated to different programs in 2015 (42 ha0. distributed planting material 19 000 families
- The tissue culture laboratory maintained **107** clones and produced **32485** plantlets.
-
- Also a total of 320 vines, **16 varieties**, were received from Malawi for cleanup.
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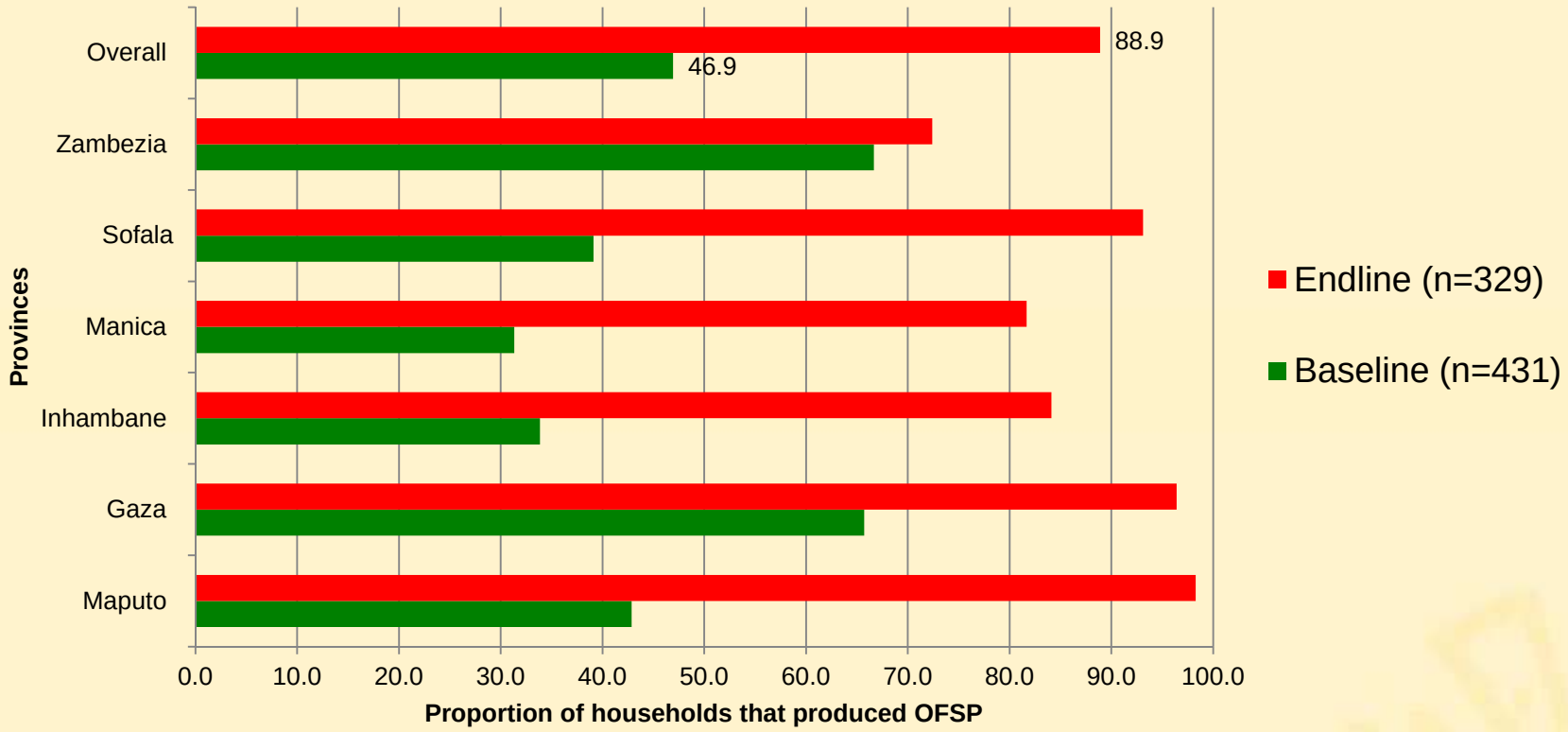
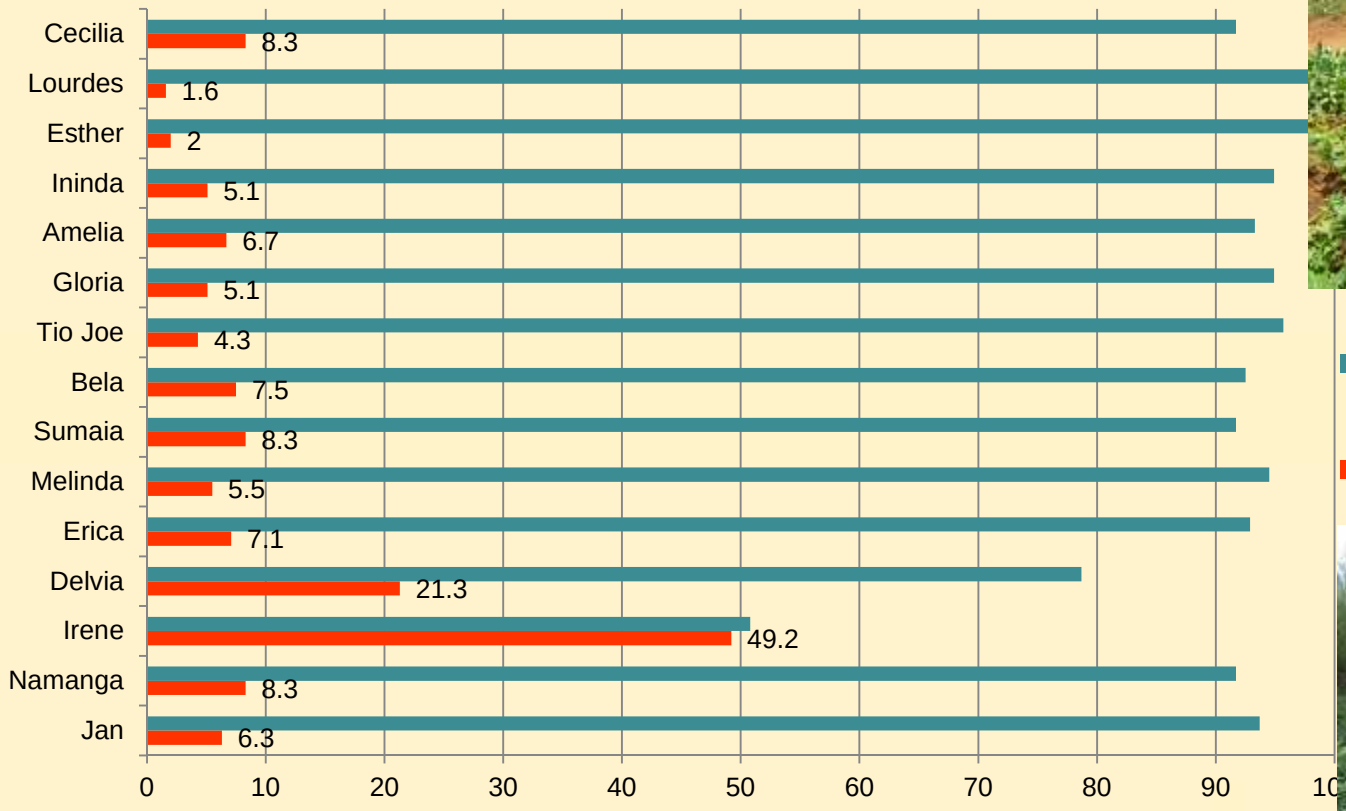
- Another set of 9 local clones were also subjected to thermotherapy for virus elimination, also **162** plantlets introduced into thermotherapy

OFSP Production



Acceptance of varieties 2 years after the first distribution (End line 2014)



Capacity Building

- Technicians/extension
- Internships (students)
- OFT

Student Trials

Gurue – **BSc** Student trials.

- **Effect** of different fertiliser (N) application rates on yield of 12 sweetpotato varieties
- **Effect** of different harvesting dates on yield and quality of 18 sweetpotato varieties

Umbeluzi

- **Ph.D.** trials – effects of intercropping sweetpotato with groundnuts and soyabean on root yield and nutritional content of sweetpotato. The other part of the trial also investigates the effects of different P levels on sweetpotato yield and nutrient content. Legume components have been harvested

1.3.3. Hybrid Progeny Exhibiting Yield Jump of 10 to 20% in Hybrids from Populations with Drought Tolerant & Enhanced Efficiency for Drought Tolerance Breeding,

- **The Heterosis trial established at Umbeluzi, September 2014 under irrigated and water stressed. Godwill will present the preliminary results**

1.3.4 Key Milestone: Clones with 200%RDA for young children of pro-Vitamin A, 25% RDA of iron and 35% RDA of Zinc under high intakes

- **Two main crossing** blocks and a mini crossing block Purple flesh were established at Umbeluzi and Gurue.
- Selection of parents was based on drought tolerance, OF, iron and Zinc levels.

Means of Parents Selected for Objective 1.3.4 I in Gurue & Umbeluzi 2015

	RYLD	VY	DM	BC	Taste	Vir	Prot	Fe	Zn
	(T/ha)	T/ha)	(%)	mg/ 100g			(%)	mg/ 100 g	mg/ 100g)
Gurue Trait Mean	18.0	16.0	28	**35**	3.0	2.0	5.0	**2.1**	**1.32**
Umb trait Mean	14.0	16	29	**31**	3.0	2.0	4.3	**1.8**	**1.1**
Purple	11.0	18	**34**		1.0			**1.7**	**1.1**

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Thank you