Summary of Sweetpotato Breeding Progress for the East and Central Africa Support Platform 2009-2014

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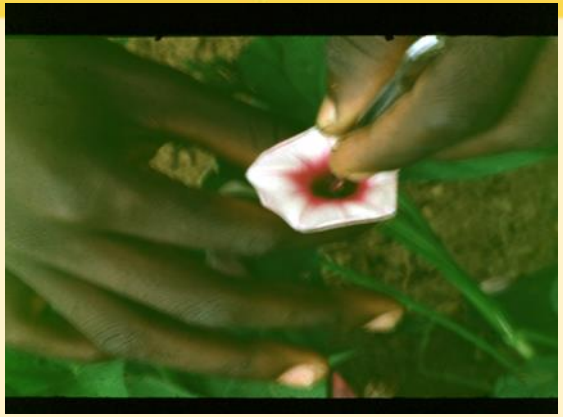
SWEETPOTATO ACTION FOR SECURITY AND HEALTH IN AFRICA

Outline of presentation

- Main objectives of sweetpotato breeding in East and Central Africa
- Progress to date



Objective: breed new populations with new methods & varietal development

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- Generate a radically **expanded range of sweetpotato varieties** that combine different quality traits with significant improvements in yielding ability
- Generate by **population improvement** new populations for major needs of users:
  - **Sweetpotato virus disease (SPVD) resistance (East Africa**)
  - **Incorporate important traits** e.g. high beta-carotene content, dual purpose types for animal feed

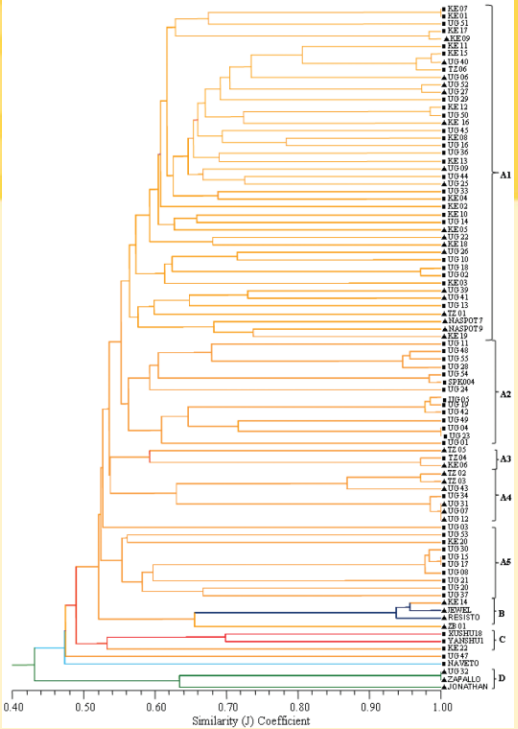
Main Objective, continued

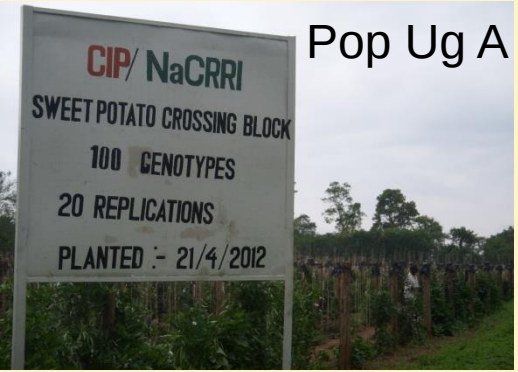
- Other new breeding methods to use:
  - heterosis into sweetpotato breeding
  - molecular markers for breeding for virus resistance

- Redesign the sweetpotato breeding systems in the region to produce varieties in 3-4 years instead of the current 7-8 years: **accelerated breeding**

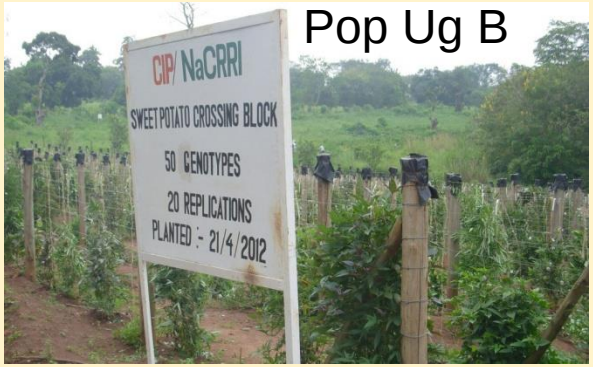
Developing populations for SPVD resistance and quality traits

- Two distinct genepools (Population Uganda A and Pop Ug B) were formed using molecular markers (18 SSR markers)
- Controlled crossing (inter- and intra-gene-pool) for population improvement and polycross crossing are in progress





Pop Ug A



Pop Ug B

Crossing between populations

Small crossing block (CB)						
Big CB	A1 Eju	A3 Dimb	A4 NAS5/58	A5 NAS7	A7 NAS10O	A8 NK297L
B1 Res	1c 207-52	3C 123-72	4C 200-7	5C 261-112	7C 98-86	8C 239-174
B2 Mag	9c 156	11c 363-2	12c 280	13c 150-243	15c 201-222	16c 262-80
B5 Mug	33c 426	35c 481	36c 16-473	37c 108-166	39c 85-39	40c 216-190
B7 Nka	49c 136-81	51c 53-226	52c 13-4	53c 259-17	55c 32-3	56c 559-143
B8 Huar	57c 890-77	59c 1543-171	60c 0-121	61c 233-125	63c 466-272	64c 495-219

Susceptible by less susceptible/resistant crosses

Resistant by resistant crosses

Total of 64 crosses
Shown: 30 crosses

Crosses within small crossing block

Parent	A1 Eju	A2 NAS1	A3 Dimb	A4 NAS/58	A5 NAS 7	A6 SPK004	A7 NAS10	A8 NK259L
A1 Ejumula	x	317-237	850-144	364-396	361-180	98-825	299-22	401 -209
A2 NASPOT 1		x	27-0	339-1089	104-4	58-54	61-160	27-17
A3 Dimbuka			x	622-684	30-19	24-6	56-723	311-320
A4 NASPOT5/58				x	320-146	153-62	5-5	299-180
A5 NASPOT 7					x	42-17	86-8	310
A6 SPK004						x	218-8	95
A7 NASPOT 10 O							x	453-187
A8 NK259L								x

Total of 28 crosses

Crosses within big crossing block (Population Uganda B)

Parent	B1 Res	B2 Mag	B3 NAS 5	B4 Wag	B5 Mug	B6 NAS11	B7 Nka	B8 Hua
B1 Resisto	x	256	367-45	124-15	451	69	666-311	453
B2 Magabali		x	154-248	223	170-50	197	680-512	43-337
B3 NASPOT 5			x	81-212	117-110	5-5	64-81	224-31
B4 Wagabolige				x	284-30	819-380	587-587	803-154
B5 Mugande					x	304-8	194-122	305-321
B6 NASPOT 11						x	65-2	224-285
B7 New Kawogo							x	1404
B8 Huarmeyano								x

Total of 28 crosses

On-going trials

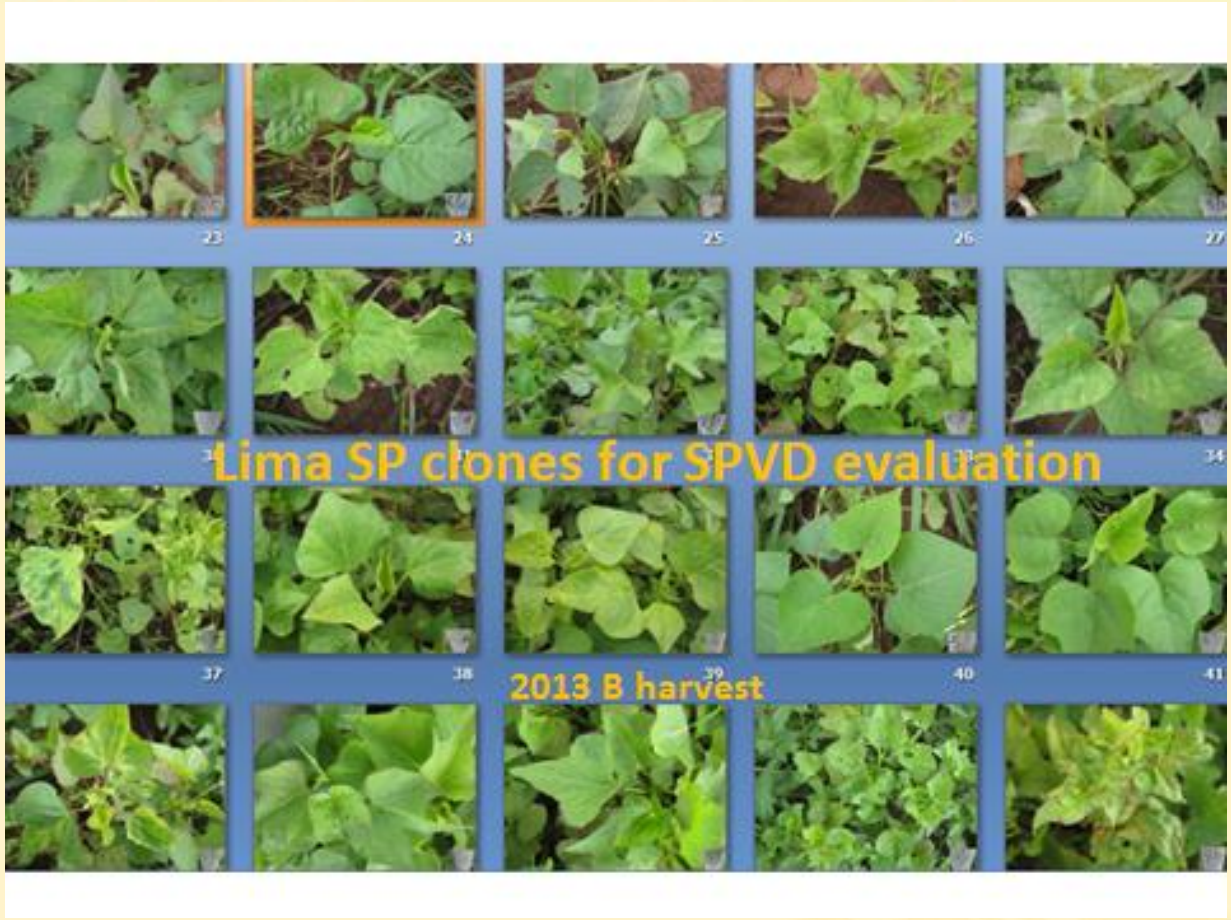
Trial	No. of clones	Sites
1) Preliminary trial (PT)	41	3 (NaCRRI, Serere, Kachwekano)
2) SPVD resistance*	81	2 (NaCRRI, Kachwekano)
3) Dual purpose/ high altitude	2,686	3 (NaCRRI, Kachwekano)
4) Controlled Vs OP		3 (NaCRRI, Serere, Kachwekano)
Ejumula x NKA	50	
OP Ejumula	105	
Wag x NASPOT 1	227	
OP Wagabolige	104	

SPVD

* From CIP/Lima

Alternaria blight

SPVD resistance evaluation CIP/Lima population



Sweetpotato Virus Disease (SPVD) Causes Significant Yield Losses (50->90%)

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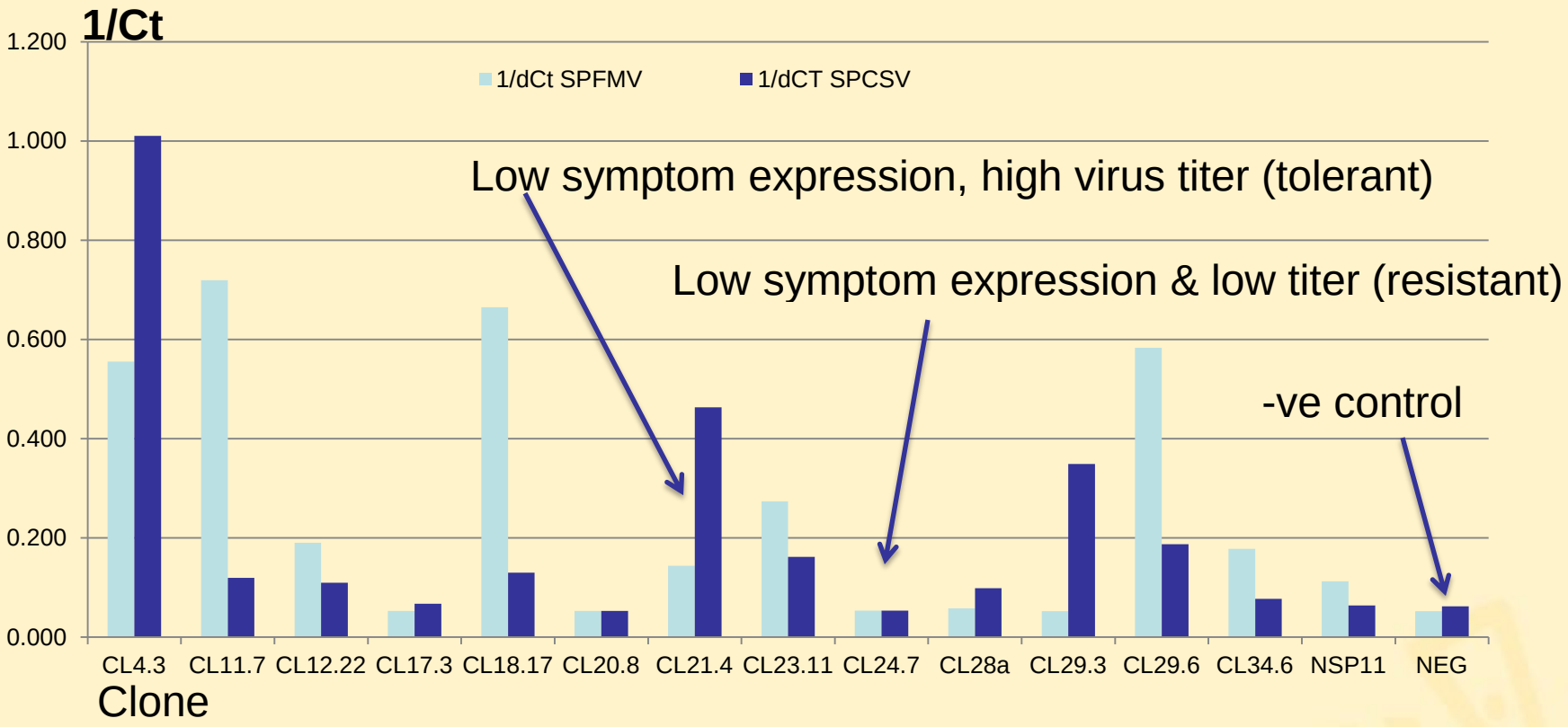
Clark et al. 2012: Plant Disease

Quantification of virus using qRT-PCR in clones from CIP/Lima, at Namulonge



May-August 2012

Status of AGRA Collaboration

AGRA countries[1]		Non-AGRA
Supported	Submitted	
Malawi (renewal/process)	Ghana (In process)	Angola
Rwanda (renewal/draft)	Uganda, approved	
Tanzania (renewal/draft)	Kenya, rejected	Burundi
Kenya (Njoro, W. Kenya)[2]	Burkina Faso[3], under review	Madagascar
Nigeria	Ethiopia[4], needed national grant	S. Africa
Zambia		
Mozambique (Renewed)		

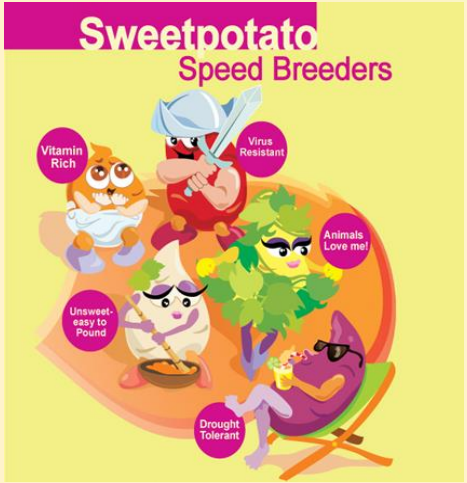
[1] Criteria for AGRA support: Active sweetpotato breeding program (full time breeder, on-going breeding activities, including crossing

[2] Funded before start of SASHA project, now 2nd phase

[3] One PhD supported by AGRA at W. African Center for Crop Improvement (WACCI), Ghana, [4]and at Kwazulu-Natal University, S. Africa

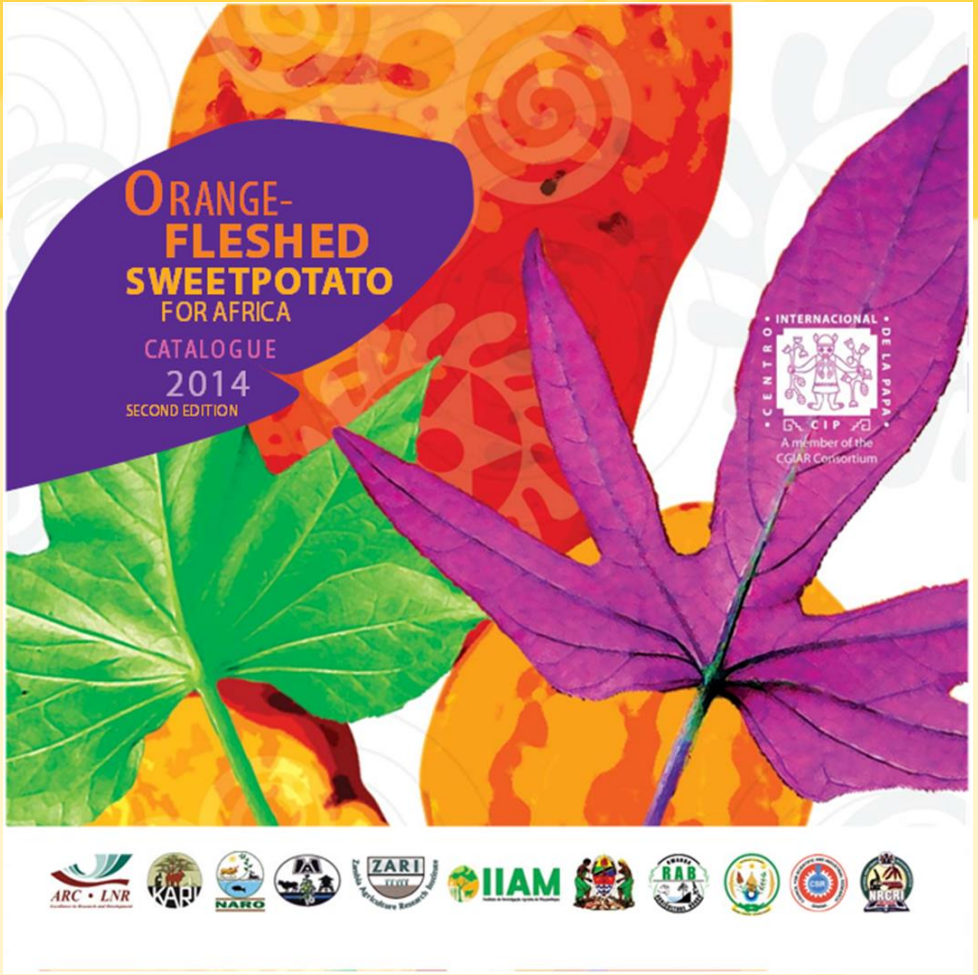
Progress: CloneSelector 3.1

- Includes Augmented and Alpha designs,
  -GGE biplot (genotype and the genotype-by-environment biplot)
  -2 multi-trait selection procedures (Elston index Pesek &Baker index)
- To date: **Sweetpotato breeders (21)** and technicians trained from **15 countries**: Malawi, Rwanda, Tanzania, Kenya, Ghana, Uganda, Ethiopia, Mozambique, Burkina Faso, S. Africa, Nigeria, Liberia, Zambia, Madagascar



OFSP Catalogue Updated (pdf)

- Collected data and pictures for all new released OFSP varieties since 2009
  - Mozambique (15)
  - Rwanda (2)
  - Malawi (4)
  - Tanzania (2)
  - Uganda (2)
  - Ghana (2)
  - Nigeria (1)
  - Zambia (3)

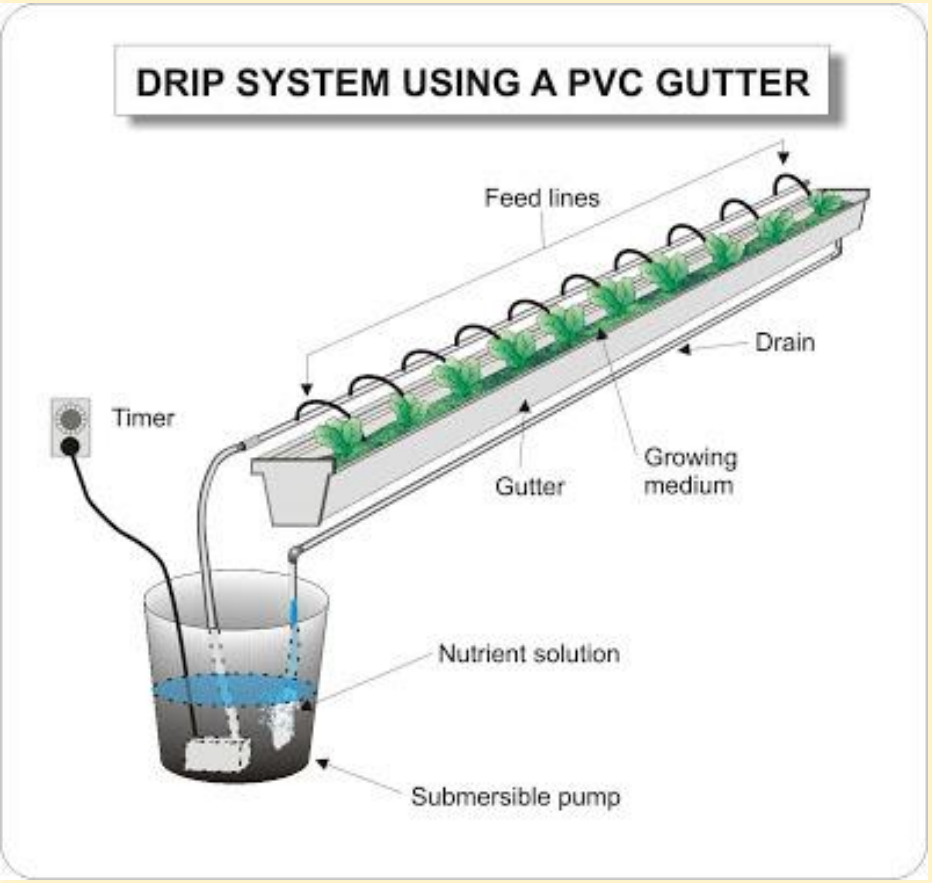


Varieties released 1992 to 2013

Country	Number of varieties released			
	1999 to 2008	2009 to 2013 (Orange flesh)		Total
Ethiopia	10	0	(0)	**10**
Ghana	0	4	(2)	**4**
Kenya	5	7	(5) -2**	**10**
Malawi	6	7	(5)	**13**
Mozambique	12	20	(15) -1**	**31**
Nigeria	3	5	(2)	**8**
Rwanda	8	11	(2)	**19**
S. Africa	11	18	(5)	**29**
Tanzania	6	7	(2)	**13**
Uganda	19	3*	(2)	**22**
Zambia	7	5	(3)	**12**
Total	**87**	**84**	(36)	**171**

*2013 Application for variety release done; ** 1st released in Uganda

Hydroponics (sand/aero)



Nutrient content of the solution (220 l)

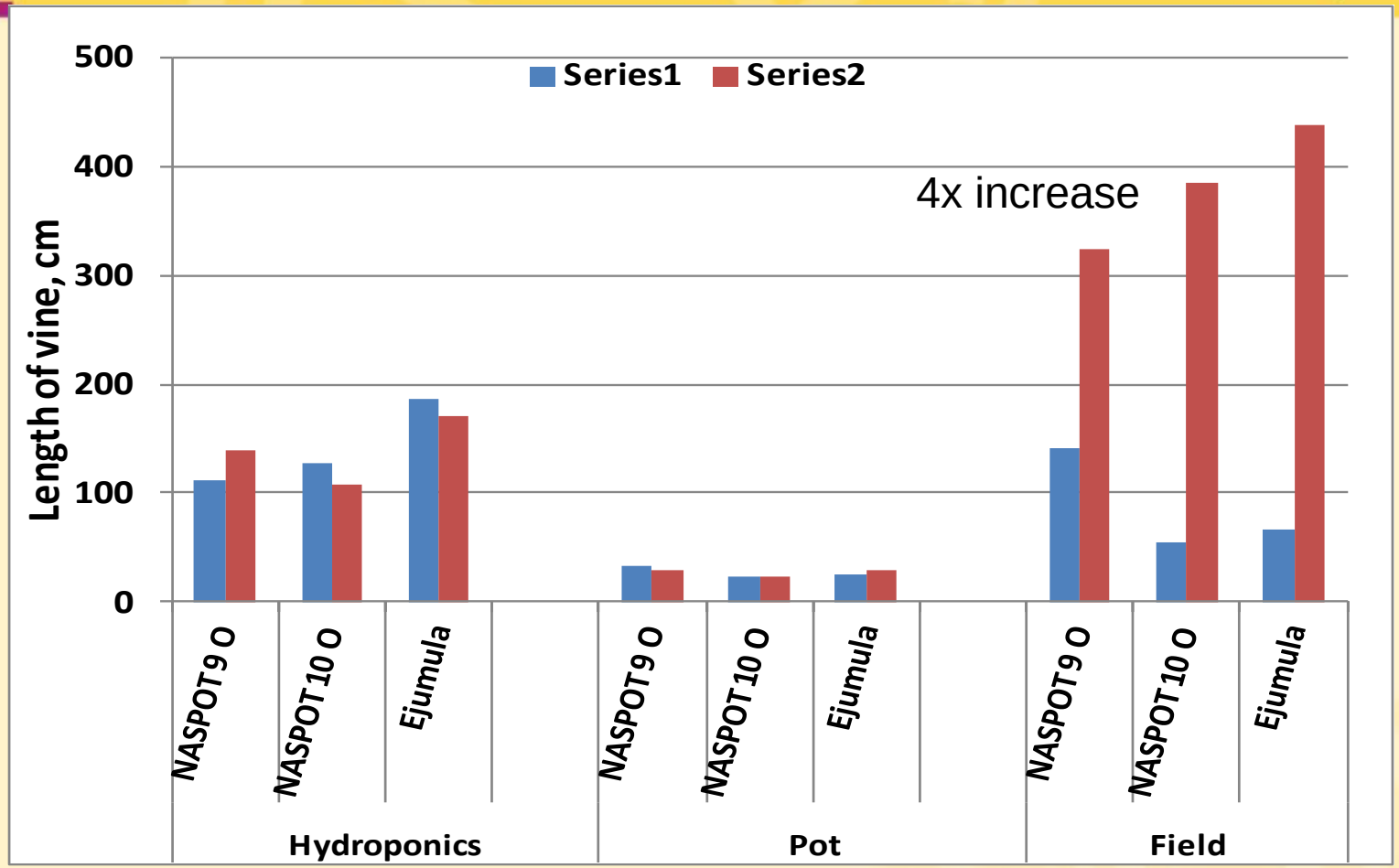
Nutrient		weight (g)	Details
Calcium nitrate	Ca(NO3)2.4H2O	11.8	NPK, 15-0-0
Potassium phosphate	KH_2PO_4	6.8	NPK, 52% P_2O_5 and 34% K_2O, or 0-52-34
Potassium nitrate	KNO_3	25.2	NPK, 13-0-44
Magnesium sulphate	$MgSO_4 \cdot 7H_2O$	5.0	16% MgO, 13% S
Micronutrients		0.6	Fe 6.5%, Mn 2%, Zn 1%, Cu 0.25%, B 2.1%, Mo 0.25% B, from Solubor, Mo from sodium molybdate and Fe, Mn, Zn, Cu micronutreints are in EDTA form

Sand hydroponics set up

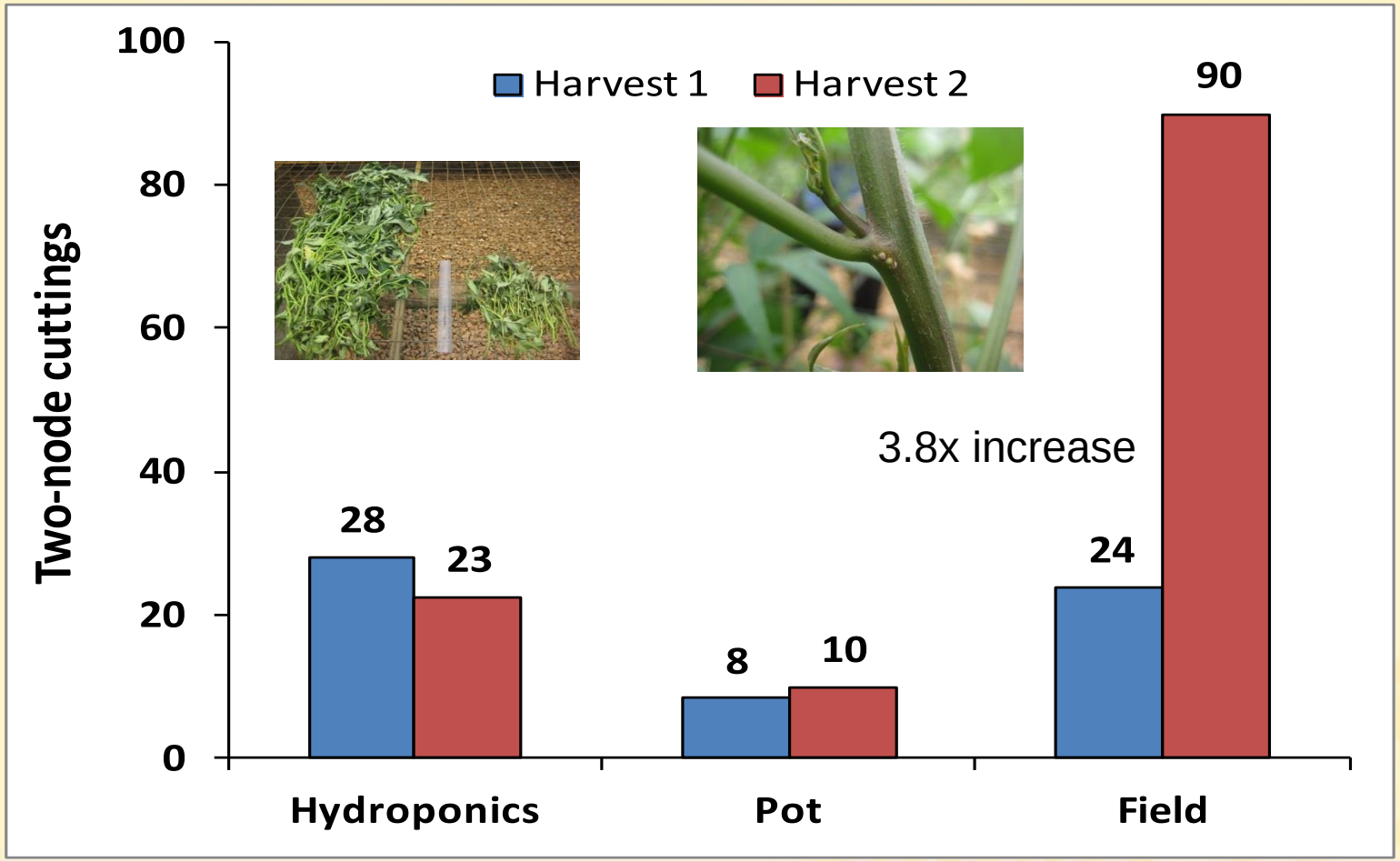
Sand hydroponics

Sand hydroponics (left) and buckets (right)

Vine length (cm) at 72 (series 1) and 46 days (series 2) after 1st and 2nd cutting



Two-node cuttings, 72 (harvest 1) and 46 days (harvest 2) after 1st and 2nd cutting



Potential and Challenges

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- Potential to produce clean stocks at low cost (vs tissue culture)
- Multiplication rate in sand hydroponics still low
- Optimize sand hydroponics conditions
- Determine economics of sand hydroponics under local conditions

Major Lessons Learned

- Changing venue for annual breeders' meeting and training exposes breeders to different methods, conditions, and challenges, enhancing the community of practice
  - 1st year: Uganda
  - 2nd year: Mozambique
  - 3rd year: Ghent University, Belgium
  - 4th year: Rwanda
  - 5th year: Malawi
- CloneSelector requires follow-up training in-country to get consistent use

Thank you for your attention

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