

Prospects and challenges for preserving and mainstreaming underutilized traditional African vegetables

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Outline

- 1) Introduction
 - Production, consumption
- 2) Germplasm Conservation
- 3) Technology generation
- 4) Seed system
- 5) Technology dissemination
- 6) Opportunities and Challenges for TAVs. R&D
- 7) Conclusions

INTRODUCTION

Various Types of TAVs

Spiderplant



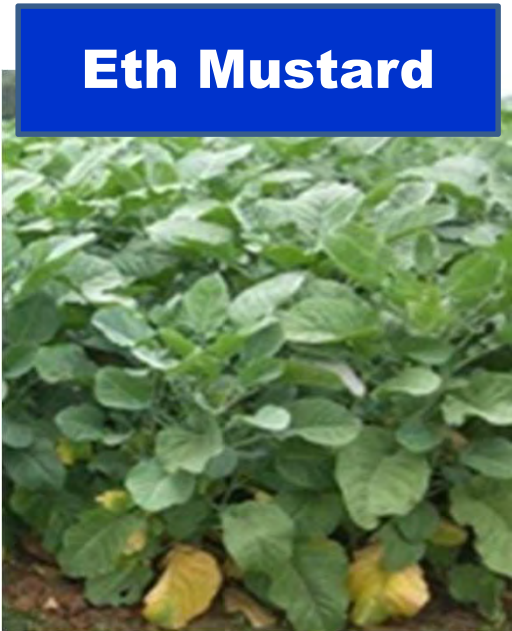
A. eggplant



African Nightshade



Eth Mustard



Amaranth



Vegetable cowpea



- Okra
- Sweet potato leaves
- Pumpkin



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The Importance of TVs vary from country to country, Source: AVRDC, 2008

Crop	Cameroon	Mali	Madagascar	Tanzania
Amaranth	6	4	2	1
African eggplant		3	7	7
African night shade	1		3	6
Okra	4	1		3
Pumpkin			1	2
Sweet potato leaf			6	4
Cassava leaf			8	9
Ethiopian mustard				8
Wild cucumber				10
Cowpea leaves				5
Spider plant				11
Jute mallow	8			
Roselle		2		
Spilanthes			4	
Black jack			5	
Total No. of major TVs	4	4	8	11

TAVs are sources of micronutrients for resource-poor people

Crop	Protein	Vit A	Vit C	Vit E	Folate	Ca	Fe	Zn	AOA	Oxalate
	g	Ug RE	mg	mg	µg	mg	mg	mg	µmol E	Mg
African Egg plant	1.19	0	12	0.5	19	12	0.65	0.15	175	19
Vegetable cowpea	3.06	30	42	0.5	82	83	1.20	0.61	1055	128
Amaranth	3.52	559	78	2.21	82	582	3.35	1.48	580	479
Ethiopia mustard	3.37	49	183	1.8	107	140	1.27	0.66	849	13
Nightshade	4.69	827	132	2.1	58	206	3.89	0.93	683	60
Jute mallow	5.13	540	92	2.8	47	213	2.89	0.77	508	87
Spider	4.55	449	117	0.6	199	196	2.15	0.89	1855	74



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Vegetable Consumption Varies with Country (Ruel et al. 2005)

- **Kenya:** 147 kg/person per year in urban & 73 kg rural areas
- **Ghana:** 50 kg/person
- **Malawi, Tanzania and urban Guinea:** each 40 kg/person/yr
- **Ethiopia:** about 25 kg/person

Income level affects consumption of TAVs (Weinberger & Msuya, 2004)

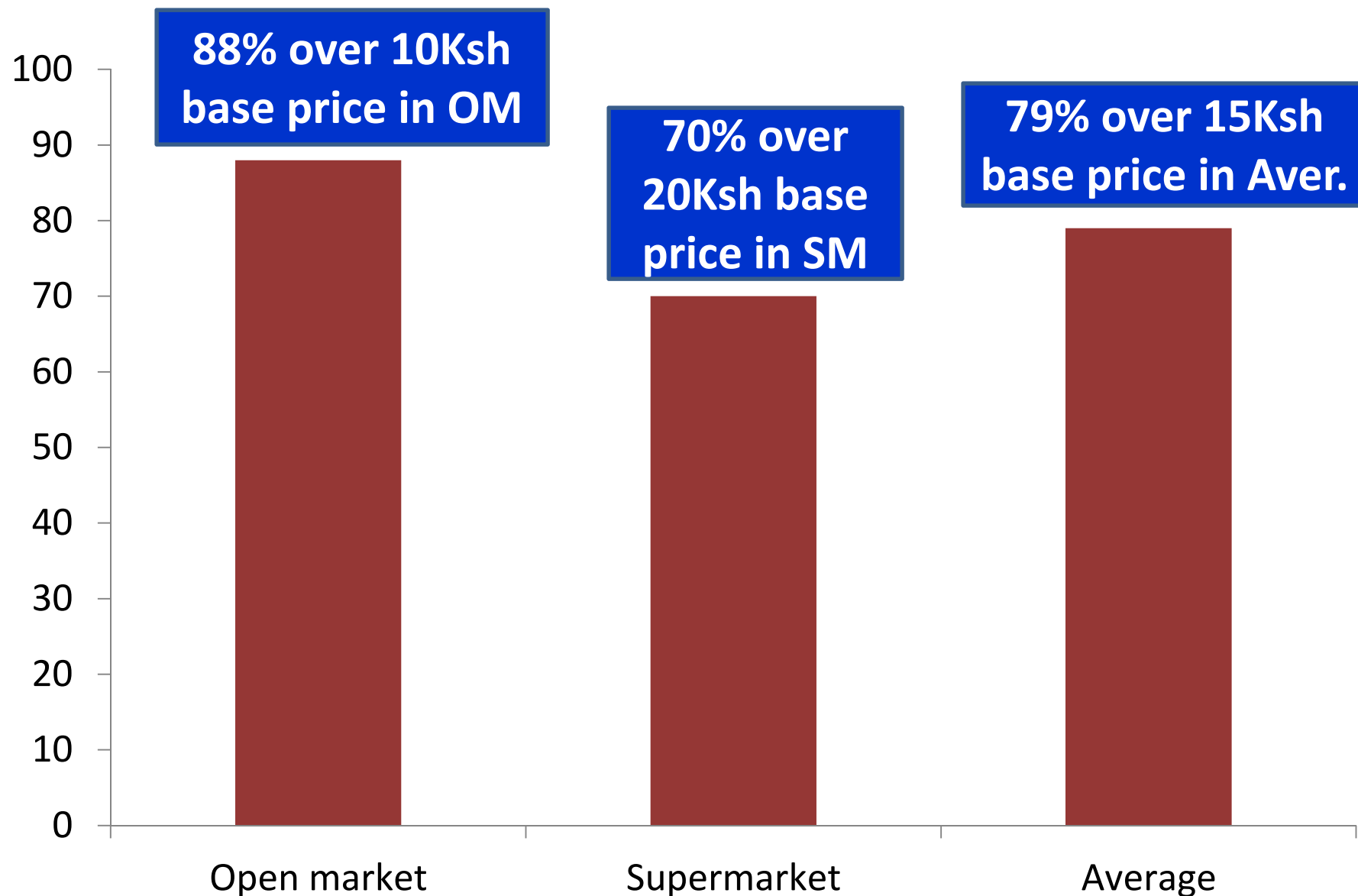
- The value of TVs consumption reaches 11% of the value of all foods consumed by resource-poor people and only 2% for resource-rich households
- Approximately 1/2 of vitamin A and 1/3 of iron requirements of resource-poor people come from TVs
- There is increasing trends of vegetable consumption by all income levels (Mwangi and Kimathi, 2006)



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Consumers willingness to pay premium price for TAVs, Eldoret town, Kenya (Chelang'a et al. 2013)



The wide genetic variability available among farmers' cultivars deserve **CONSERVATION**



TAVs Conservation...

- But TVs are less considered in national biodiversity conservation programs
- AVRDC has been working not only in improvement but also in conservation of vegetables
 - It has the largest vegetable gene bank in the world

Over 1700 TVs have been conserved at RCA, Arusha/Tanzania, 2012

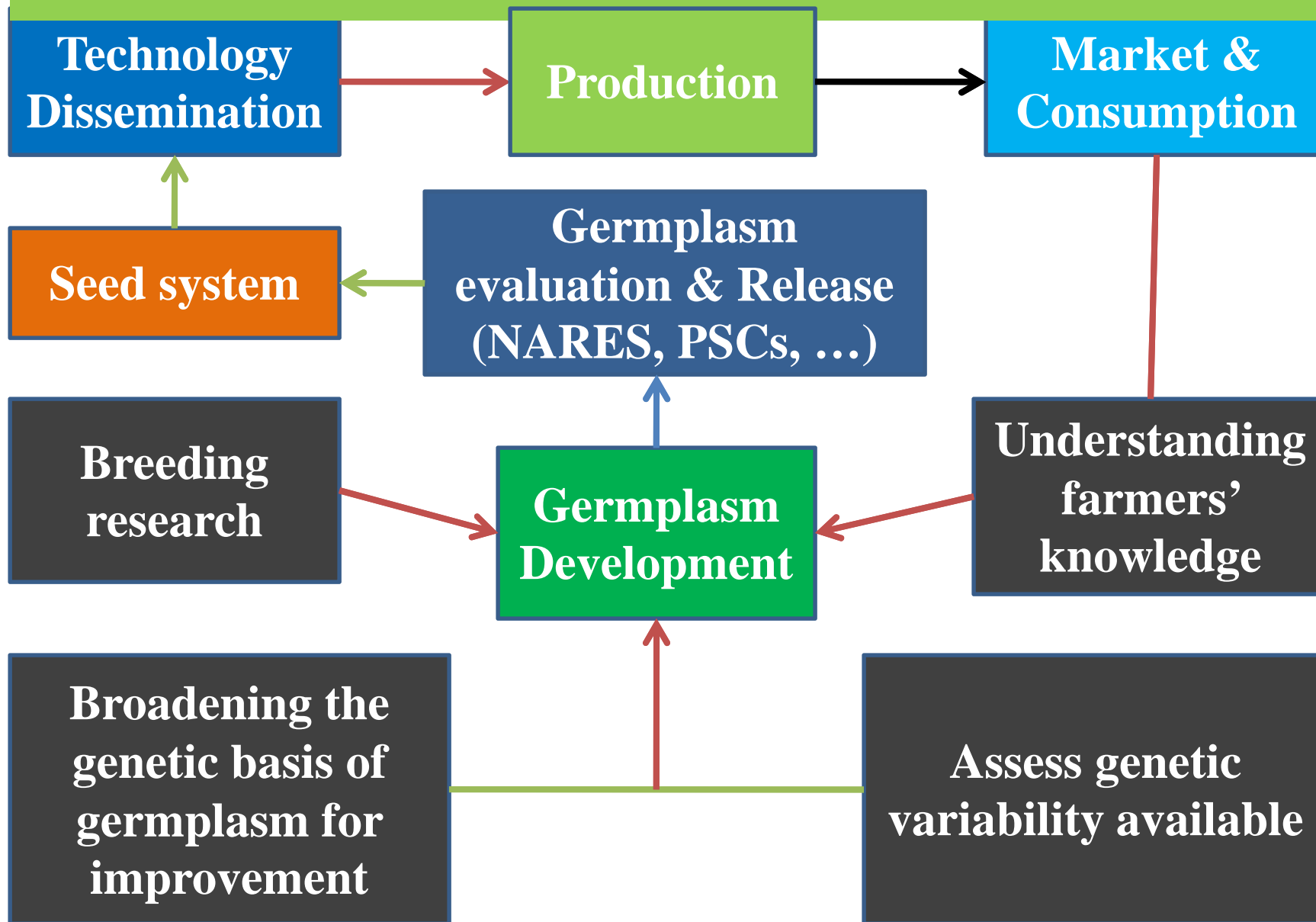
Crops	Family	Scientific name	No. of Species	No. of accessions/ Lines	No. of countries of origin*
African eggplant	Solanaceae	<i>Solanum spp.</i>	5	353	22
African nightshade	Solanaceae	<i>Solanum spp.</i>	8	128	3
Amaranth	Amaranthaceae	<i>Amaranthus spp.</i>	8	141	13
Jute mallow	Tiliaceae	<i>Corchorus olitorius</i>	1	38	8
Ethiopian mustard	Cruciferae	<i>Brassicacarinata</i>	1	60	3
Spiderplant	Capparidaceae	<i>Cleome gynandra</i>	1	93	7
Sunhemp	Fabaceae	<i>Crotolaria spp.</i>	8	22	1
Cowpea leaf	Leguminosae	<i>Vigna unguiculata</i>	1	126	4
Mungbean	Leguminosae	<i>Vigna radiata</i>	1	73	4
Pumpkin/squash	Cucurbitaceae	<i>Cucurbita spp.</i>	3	56	6
Moringa	Moringaceae	<i>Moringa oleifera</i>	1	10	1
Okra	Malvaceae	<i>Abelmoschus spp.</i>	3	315	11
Roselle	Malvaceae	<i>Hibiscus sabdariffa</i>	1	298	8
Vegetable soybean	Leguminosae	<i>Glycine max</i>	1	4	-
Hyacinth bean	<i>Hyacinth bean</i>	<i>Lablab purpureus</i>	1	41	3
Total				1758	

Source: AVRDC-RCA Gene bank database, the collections were made from 35

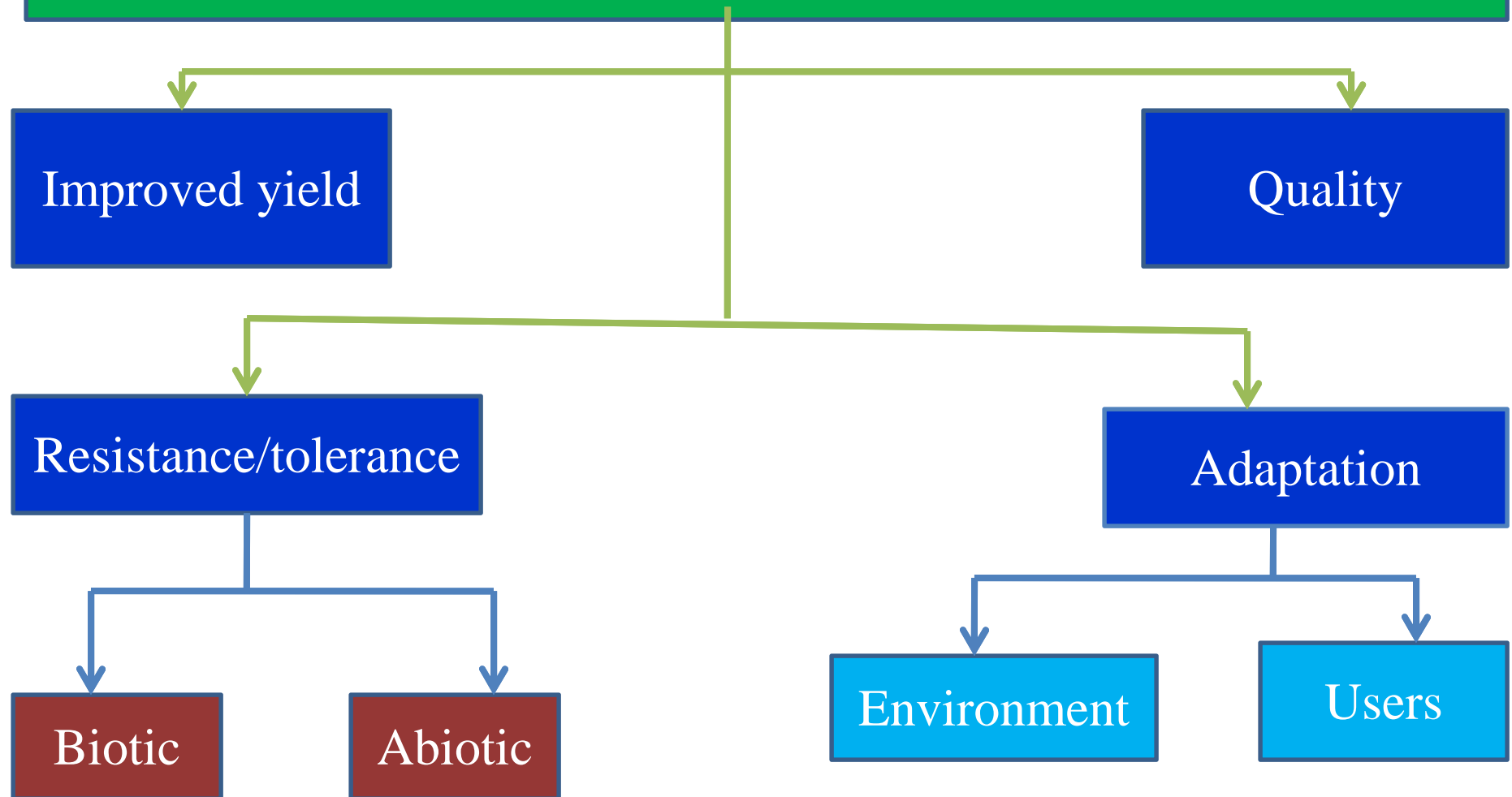
TAVs GERMPLASM IMPROVEMENT IN SSA

- Less support for veg. germplasm improvement in SSA
- AVRDC has been working to establish sustainable vegetable improvement and seed systems in the region and other parts of developing world
 - Capacity development (researchers - extension - farmers)

TVs Germplasm Development at AVRDC



Breeding Objectives



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Plant part to be Improved Determines Breeding Objectives

Leaf Amaranth: High leaf biomass

Grain Amaranth: white high grain yield



Photo: Fekadu, 2013

Farmers Small Scale Processing group, Tanzania



Lodging for grain type amaranth



Breeding objective...

Dual Purpose Amaranth (leaf + Grain)



- Rapid recovery from repeat leaf harvesting/topping
- Long vegetative duration & delayed flowering

Photo: Fekadu, 2013



- White, creamy or brown grain
- **Repeat leaf harvesting best fits home garden**, food supply over a longer period of time, reduce risk of facing low market price



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Stage at which leafy vegetables harvested determine breeding objectives

Ready for first harvest 21-45 days after sowing based on environment & crop

- Amaranth (*Amaranthus* spp.)
- A.Nightshade (*Solanum* spp.)
- Ethiopian mustard (*Brassica carinata*)
- Spiderplant (*Cleome gynandra*)



Photo: Fekadu, 2013, SUA

Late stage biotic & abiotic stresses are not very important



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Strategy of Participatory Germplasm Development

Strategy of adapting technology not only to environment but also to users



Adoption rate reaches ceiling fast in technologies generated through participatory approach



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Germplasm Distribution is part of Mainstreaming TVs improvement in SSA

Various categories of germplasm distributed for partners to use

Health Diet Gardening Seed Kit



- Accessions
- Advanced lines
- Commercial varieties

To Various Organizations

- NARES, PSCs
- Higher Learning Institutes
- NGOs in Agri. Development
- Relief Organizations
- Individual/group of farmers



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No. of TAVs registered from AVRDC lines in some countries in Africa since 1983

Variety by Crop	No Variety	Year	Country
African Eggplant	6	1999-2011	Tanzania, Uganda, Mali
Amaranth	6	2011	Tanzania, Uganda, Mali
African Nightshade	5	2006-2012	Tanzania, Kenya
Ethiopian mustard	2	2011	Tanzania
Okra	5	2007-2011	Tanzania, Uganda, Mali
Roselle	3	2011	Mali
Vegetable Soybean (+2 grain)	6	1983-2006	Zimbabwe, Mauritius, Sudan
Mungbean	2	1983-1987	Tanzania, Somali
Cowpea	1	-	Tanzania
Jute Mallow	1	-	Uganda
total	37	-	

SEED SYSTEMS

- Staple crops are the main focus of public seed system, vegetables are not handled in many cases
- Lack of **variety protection and a royalty system** pulls back seed companies from involving in TVs/OPVs

A number of Companies in Commercialization



Farmers or farmers' organizations are major source (Source 2003)

- 69% is farm-saved seed
- 11% from local markets, farmers associations, NGOs
- About 20% from local seed dealers/company
- There is a change in the situation

Seed companies Tanzania & Kenya

- Alpha Seeds
- East Africa Seeds
- Kibo Seeds
- Simlaw Seeds
- Lagrotech Seeds
- Simlaw Seeds

Uganda

- Victoria seeds
- FICA Seeds
- Mount Elgon

Mali: Faso Keba



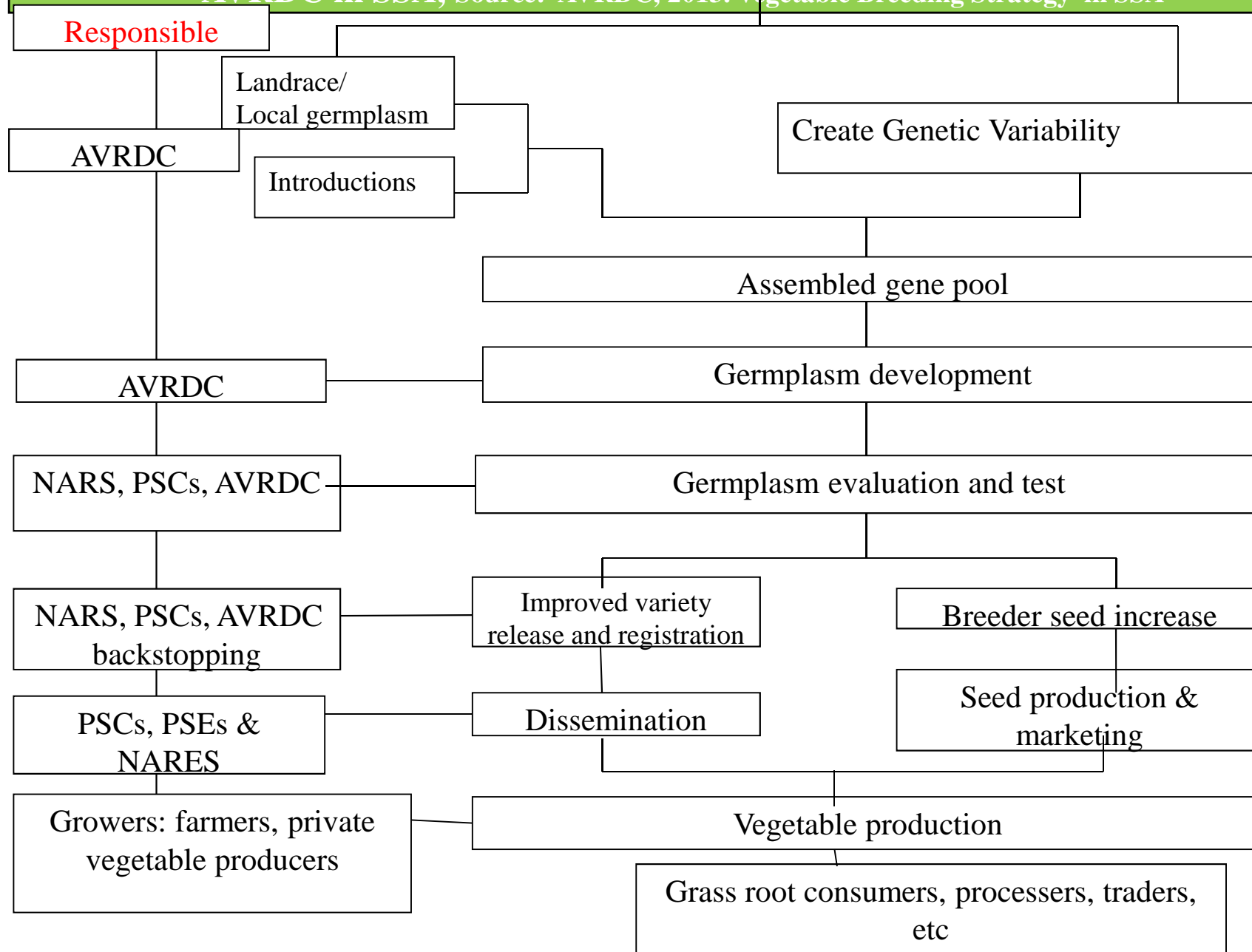
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TECHNOLOGY DISSEMINATION

- Utilization of improved technology is very important to justify efforts and resources spent on technology generation
- Received less emphasis with National Extension System
- However, there have been a number of efforts at AVRDC, JKUAT, ASARECA, Bioversity, and other institutions to promote TVs

Flow of Germplasm Development, Variety Release and Deployment at AVRDC in SSA, Source: AVRDC, 2013. Vegetable Breeding Strategy in SSA



OPPORTUNITIES AND CHALLENGES FOR TAVs IMPROVEMENT & DEVELOPMENT



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Opportunities for TVs

- Focus of the world on nutritional security and understanding of the nutritional value of TVs
- TVs are food security crops in seasons of food shortage
- Diversify and generate income, especially for women
- Globalization: Increased movement of people increases the chance of learning others food habit
- Medicinal value of some TVs, increased interest to explore

Opportunity for TVs...

- Traditional leafy vegetables are environmental resilient due to their hardiness (weedy nature), rapid sprouting and maturity escaping late stage biotic and abiotic stresses
- Growing interest of scientists in TVs
- Improved willingness of donors to invest in TVs
- Became business sector for seed companies
- Increased focus on post-harvest handling encourages more production

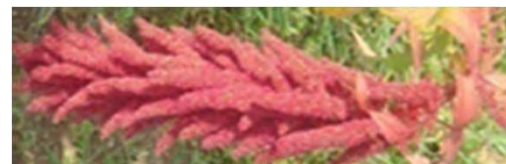


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Emerging new products from TVs

Emerging small-scale processing firms, e.g., amaranth grain processing farmer groups in Tanzania



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Challenges in TAVs R&D

- Less emphasis from NARES for improvement and development of TVs
- No/less attention from National PGR Centers for conservation
- Less focus from the science world
- Less critical mass of expertise in TVs

Challenges in TAVs R&D...

- TVs are orphan crops in the seed system
- Lack of variety protection and a royalty system
- TVs are not adequately absorbed in national policies and strategies, and by donor communities
- Benefits of TVs are not well communicated to the grass root level consumers, government policy- & decision-makers

Conclusions

- Advantages of TVs have been almost absent in fora debating on climate change, food and nutrition security, and poverty reduction
- Need of especial support from the public sector and donors for improved seed supply system
- GERMPLASM CONSERVATION and USE: The genetic resource of NUS is silently dying without their importance and use noticed. So what to do?

Conclusions...

- Establish information exchange among countries at policy makers level, farmers & grass root consumers levels.
- Making available balanced diet on sustainable basis to the large majority of resource-poor people in developing countries is challenge
 - Which approach to take for sustainable solution?
 - Supplements from industrial product or a system that can be incorporated into regular dishes of people?



Thanks