

# Everything You Ever Wanted to Know about Sweetpotato

Reaching Agents of Change ToT training manual



## VOLUME 1

Topic 1: Helping Adults to Learn

Topic 2: Origin and Importance of Sweetpotato

Topic 3: Sweetpotato Varietal Selection and Characteristics



JUNE 2013

## **Everything You Ever Wanted to Know about Sweetpotato**

Reaching Agents of Change ToT Training Manual

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**ISBN:** 978-92-9060-427-3

**DOI:** 10.4160/9789290604273

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Produced by CIP-Sub-Saharan Africa Regional Office (SSA), Nairobi

### **Correct citation for the entire manual:**

Stathers, T., Low, J., Mwanga, R., Carey, T., David, S., Gibson, R., Namanda, S., McEwan, M., Bechoff, A., Malinga, J., Benjamin, M., Katcher, H., Blakenship, J., Andrade, M., Agili, S., Njoku, J., Sindi, K., Mulongo, G., Tumwegamire, S., Njoku, A., Abidin, E., Mbabu, A. (2013). *Everything You Ever Wanted to Know about Sweetpotato: Reaching Agents of Change ToT Manual*. International Potato Center, Nairobi, Kenya. 7 vols. x , 390 p.

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### **Printing**

Clean Tone (Nairobi, Kenya)

**Press run:** 500

December 2013

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Stathers, T., Low, J., Carey, T., Mwanga, R., Njoku, J., Tumwegamire, S., Malinga, J., Andrade, M. (2013). *Everything You Ever Wanted to Know about Sweetpotato*: Reaching Agents of Change ToT Manual. 1: Helping adults to learn; Origin and importance of sweetpotato; Sweetpotato varietal selection and characteristics. International Potato Center, Nairobi, Kenya. vol.1.

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## Foreword

During the past decade, interest in sweetpotato in Sub-Saharan Africa (SSA) has been expanding, the number of projects utilizing sweetpotato increasing, and the demand for training development practitioners and farmers subsequently rising as well. Sweetpotato scientists at the International Potato Center and national research centres often receive these requests and frequently hold 1-3 day training sessions, drawing on whatever training materials they have or can quickly pull together. The inadequacy of this approach has been quite apparent, but resources to address the problem were not available until now.

The funding of the Reaching Agents of Change (RAC) project in 2011 has changed the situation. Jointly implemented by the International Potato Center (CIP) and Helen Keller International (HKI), RAC seeks to empower advocates for orange-fleshed sweetpotato (OFSP) to successfully raise awareness about OFSP and mobilize resources for OFSP projects. RAC also seeks to build the capacity of public sector extension and non-governmental organizational personnel to effectively implement those projects funded to promote the dissemination and appropriate use of vitamin A rich, orange-fleshed sweetpotato. The goal is to see *sustained* capacity for training senior extension personnel about the latest developments in sweetpotato production and utilization in each of the major sub-regions of SSA: Eastern and Central Africa, Southern Africa, and West Africa. Hence, CIP has identified a local institution to work with in Mozambique, Tanzania, and Nigeria to host an annual course entitled: *Everything You Ever Wanted to Know about Sweetpotato*. During the first cycle of this course, CIP scientists worked closely with national scientists in implementing the course. During the second cycle, the national scientists will lead the training activities and course management with backstopping from CIP personnel. During the third cycle, national scientists will organise and conduct the course with just financial support from the project. In subsequent years, we hope that the course will have become fully self-sufficient on a cost recovery basis.

In developing the course content, a long-time collaborator of CIP, Dr. Tanya Stathers of the Natural Resources Institute (NRI), University of Greenwich, has led the review of existing training material, added in new knowledge from sweetpotato scientists and practitioners, and designed the course with a heavy emphasis on learning-by-doing. Dr. Stathers previously collaborated with CIP, Ugandan sweetpotato scientists from the National Agriculture Research Organization (NARO), and FAO Global IPM Facility in Kenya on a field project which developed a comprehensive Sweetpotato IPPM Farmers Field School manual for Sub-Saharan Africa in 2005. In developing the course, Dr. Stathers has consulted CIP personnel (Robert Mwanga, Ted Carey, Jan Low, Maria Andrade, Margaret McEwan, Jude Njoku, Sam Namanda, Sammy Agili, Jonathan Mkumbira, Joyce Malinga, Godfrey Mulongo) and HKI nutritionists (Margaret Benjamin, Heather Katcher, Jessica Blankenship) and an HKI gender specialist (Sonii David) as well as her fellow NRI colleagues (Richard Gibson, Aurelie Bechoff, Keith Tomlins). She adapted training material from the DONATA project, the Reaching End Users project and many others. After running the course and using the manual in 2012, a review was held and the manual and course were subsequently updated to meet facilitators and participants demands, and a standard set of accompanying Power Point presentations were created. Dr. Stathers has done a tremendous job and we deeply appreciate her commitment to producing this high quality manual.

The level of this course is aimed at senior extension personnel or leaders of farmer organizations who will in turn train others. We envision the course to be improved on an annual basis as new knowledge comes in and based on feedback received from the course participants. In this way, we expect the vibrant and knowledgeable sweetpotato community of practice to continue to grow in the coming years. The *Everything You Ever Wanted to Know about Sweetpotato* course will help us to achieve the major objectives of the Sweetpotato Profit and Health Initiative (SPHI). Launched in October 2009, the SPHI seeks to improve the lives of 10 million sub-Saharan African families in 16 countries by 2020 through the diversified use of improved sweetpotato varieties.



Jan W. Low, Leader of the Sweetpotato for Profit and Health Initiative, International Potato Center  
June 2013

## Acknowledgements

This manual and the supporting training materials were prepared by Tanya Stathers in close collaboration with Jan Low. Tanya worked together with the following resource people on the different topics: Topic 2: Jan Low; Topic 3: Ted Carey, Robert Mwanga, Jude Njoku, Silver Tumwegamire, Joyce Malinga, Maria Andrade; Topic 4: Margaret Benjamin, Heather Katcher, Jessica Blakenship, Jan Low; Topic 5: Margaret McEwan, Richard Gibson, Robert Mwanga, Ted Carey, Sam Namanda, Erna Abidin, Jan Low, Joyce Malinga, Sammy Agili, Maria Andrade, Jonathan Mkumbira; Topic 6: Ted Carey, Robert Mwanga, Jude Njoku, Joyce Malinga, Anthony Njoku; Topic 7: Richard Gibson, Sam Namanda; Topic 8: Aurelie Bechoff, Kirimi Sindi; Topic 9: Aurelie Bechoff, Kirimi Sindi; Topic 10: Jan Low, Kirimi Sindi, Daniel Ndyetabula; Topic 11: Sonii David; Topic 12: Jan Low, Godfrey Mulongo, Adiel Mbabu; Topic 13: Jan Low. Hilda Munyua, Adiel Mbabu and Frank Ojwang have provided invaluable support throughout the process.

This team has brought together and shared their many years of experience of working with sweetpotato systems and farmer learning processes across Sub-Saharan Africa to compile this *Everything You Ever Wanted to Know about Sweetpotato* resource. None of this experience would have been gained without the partnership of many sweetpotato farmers and other stakeholders (extensionists, national researchers, traders, transporters, NGO staff, nutritionists, media and donors) across the region. We thank you, and hope that this resource can in return offer you support in your sweetpotato activities.

The photographs used throughout this manual come from a wide range of places and we thank Margaret McEwan, Jan Low, Richard Gibson, Erna Abidin, Aurelie Bechoff, Keith Tomlins, Sam Namanda, J. O'Sullivan, Gabriela Burgos, Tanya Stathers, Olasanmi Bunmi, Benson Ijeoma, Grant Lee Neurenberg, Sammy Agili, the late Constance Owori, Ted Carey, Robert Mwanga, Ana Panta, Kirimi Sindi, Frank Ojwang, CIP digital archive, G. Holmes, B. Edmunds, and Nicole Smit for kindly sharing them. Most of the cartoons used in this manual were drawn by Movin Were.

This manual has been produced as part of the Reaching Agents of Change project funded by the Bill & Melinda Gates Foundation.

This manual should be cited as follows:

Stathers, T., Low, J., Mwanga, R., Carey, T., David, S., Gibson, R., Namanda, S., McEwan, M., Bechoff, A., Malinga, J., Benjamin, M., Katcher, H., Blakenship, J., Andrade, M., Agili, S., Njoku, J., Sindi, K., Mulongo, G., Tumwegamire, S., Njoku, A., Abidin, E., Mbabu, A. (2013). *Everything You Ever Wanted to Know about Sweetpotato*: Reaching Agents of Change ToT Manual. International Potato Center, Nairobi, Kenya. pp390+ x

## Acronyms and abbreviations

ACIAR	Australian Centre for International Agricultural Research	IPPM	Integrated Pest&Production Management
AIs	Adequate Intakes	IRETA	Institute for Research Extension and Training in Agriculture
ARMTI	Agricultural and Rural Management Training Institute	K	Potassium
ASCII	American Standard Code for Information Interchange	LGA	Local Government Areas
AVRDC	The World Vegetable Centre	LGB	Larger Grain Borer
BMGF	Bill and Melinda Gates Foundation	LZARDI	Lake Zone Agricultural Research and Development Institute (Tanzania)
CBO	Community Based Organisation	M&E	Monitoring and Evaluation
CGIAR	Consultative Group on International Agricultural Research	MAP	Months After Planting
CIAT	International Centre for Tropical Agriculture	m.a.s.l.	metres above sea level
CIP	International Potato Center	MM	Mass Multiplication
DAP	Days After Planting	MRC	Medical Research Council, South Africa
DFE	Dietary Folate Equivalents	MSC	Most Significant Change
DONATA	Dissemination of New Agricultural Technologies in Africa	N	Nitrogen
DVM	Decentralised Vine Multipliers	NARO	National Agricultural Research Organisation
EMU	Eduardo Mondlane University	NAS	National Academy of Sciences
dwb	Dry weight basis	NBS	National Bureau of Statistics
FAEF	Faculty of Agronomy and Forestry Engineering	NGO	Non Government Organisations
FAO	Food and Agriculture Organisation of the United Nations	NHV	Negative Horizontal Ventilation
FC	Food Consumption	NPC	National Population Commission
FW	Fresh Weight	NPCK	National Potato Council of Kenya
GI	Glycemic Index	NPK	Nitrogen, Phosphorus, and Potassium
HH	Household	NRI	Natural Resources Institute
HIV/AIDS	Human Immunodeficiency Virus / Acquired Immunodeficiency Syndrome	OFSP	Orange-fleshed sweetpotato
HKI	Helen Keller International	P	Phosphorous
IBPGR	Bioversity International	PMCA	Participatory Market Chain Approach
IFPRI	International Food Policy Research Institute	PMS	Primary Multiplication Site
IIAM	Institute of Agricultural Research Mozambique	PPP	Public Private Partnership
IIED	International Institute for Environment and Development	PVC	Polyvinyl chloride
IIRR	International Institute of Rural Reconstruction	QDPM	Quality Declared Planting Material
IITA	International Institute of Tropical Agriculture	QDS	Quality Declared Seed
IMMPACT	International Micronutrient Malnutrition Prevention and Control Program	RAC	Reaching Agents of Change
IPGRI	International Plant Genetic Resources Institute	RAE	Retinol Activity Equivalents
IPM	Integrated Pest Management	RCT	Randomised Control Trial
		RDA	Recommended Daily Allowances
		RE	Retinol Equivalents
		REU	Reaching End Users
		RH	Relative Humidity
		SASHA	Sweetpotato Action for Security and Health in Africa
		SDC	Swiss Agency for Development and Cooperation
		SMS	Secondary Multiplication Site
		SP	Sweetpotato
		SPCSV	Sweetpotato chlorotic stunt virus
		SPFMV	Sweet potato feathery mottle virus

SPHI	Sweetpotato for Profit and Health Initiative	UNICEF	United Nations Children’s Fund
SPKP	Sweetpotato Knowledge Portal	UNU	United Nations University
SPVD	Sweetpotato Virus Disease	USA	United States of America
SSA	Sub-Saharan Africa	USAID	United States Agency for International Development
SUA	Sokoine University of Agriculture	USD	United States Dollar
TFNC	Tanzania Food and Nutrition Centre	USDA	United States Department of Agriculture
ToT	Training of Trainers	Ushs.	Ugandan Shillings
TMS	Tertiary Multiplication Site	USIM	United States Institute of Medicine
Tshs.	Tanzanian Shillings	VAD	Vitamin A Deficiency
TSNI	Towards Sustainable Nutrition Improvement	WAP	Weeks After Planting
UN HABITAT	United Nations Human settlement Programme	WFP	World Food Program
UNESCO	United Nations Educational, Scientific and Cultural Organization	WHO	World Health Organisation
		WTP	Willingness To Pay

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## How to use this manual

This manual contains ‘*Everything you ever wanted to know about sweetpotato*’. We hope that it will be useful for those involved in training extensionists and NGO staff at different levels, and that they in turn will train farmers in practical ways that help them to build their problem solving and decision-making skills so they can continue to learn, question, test and address different opportunities and challenges relevant to their livelihoods.

The manual consists of fourteen topics which, after the initial two topics on training and the origin and importance of sweetpotato, follow the sweetpotato crop cycle. Each topic discusses the key need to know aspects highlighting the relevant gender issues and then presents suggestions for how this topic might be incorporated in a 10 day ToT course, with step by step guidelines for several hands-on learning-by-doing activities. The last two topics focus on the ToT training course programme and preparations. The fourteen topics are:

**Topic 1: Helping Adults to Learn** discusses the characteristics of good facilitators, and provides suggestions to help improve one’s facilitation skills. It covers how to plan a training course from the needs assessment, through the development of learning outcomes, awareness raising, participant selection, development of the programme, use of discovery-based/ experiential learning approaches, follow-up and long-term monitoring and scaling up and out. The learning-by-doing activities involve the participants practicing their facilitation skills while delivering different sweetpotato topics and understanding the importance of evaluating their training.

**Topic 2: Origin and Importance of Sweetpotato** describes the historical origins and spread of sweetpotato and presents an overview of the current uses of and production figures for sweetpotato across the world.

**Topic 3: Sweetpotato Varietal Selection and Characteristics.** Sweetpotato roots range in colour from purple to orange to yellow or white. A wide diversity of leaf shapes, root sizes and shapes, tastes, textures, maturity periods and flesh colours also exist. Farmers use such characteristics to select which varieties to grow. A method for comparing the different characteristics of different varieties on-farm is described.

**Topic 4: Orange-fleshed Sweetpotato and Nutrition.** An overview of food groups and good nutrition is given, followed by discussion of the consequences of poor nutrition including vitamin A deficiency and the use of conventional breeding to biofortify crops. The benefits of eating orange-fleshed sweetpotato are discussed along with the complexities of trying to create demand for foods that help address frequently unrecognised nutritional problems such as vitamin A deficiency.

**Topic 5: Sweetpotato Seed Systems** are reviewed including the different seed multiplication levels, the roles of the different stakeholders within the system. The factors influencing decisions on whether to use a single shot or an ongoing planting material dissemination approach, and the level of subsidisation required are discussed. Examples are given for planning different types of planting material multiplication and dissemination strategies. Methods for selecting clean planting materials and then conserving and multiplying them are presented.

**Topic 6: Sweetpotato Production and Management** covers the importance of advanced planning to ensure sufficient planting materials are available at the start of the rains, land preparation, planting methods, intercropping, nutrients needs, the main growth stages and their associated management tasks.

**Topic 7: Sweetpotato Pest and Disease Management** explains how recognising the lifecycles of the damaging insect pests and diseases such as the sweetpotato weevil (*Cylas* spp.) and viruses can help farmers learn how to manage them more successfully. The signs and management strategies for mole rats and erinose are also discussed.

**Topic 8: Harvesting and Postharvest Management.** The physical damage caused during harvest and transport can reduce the shelf-life and value of sweetpotato roots. Over-drying and prolonged storage can reduce the beta-carotene content of dried orange-fleshed sweetpotato products. Good postharvest handling and storage practices for dried products are discussed, and methods for curing and storing fresh roots to increase their quality, value and availability are presented.

**Topic 9: Processing and Utilisation.** Many delicious, nutritious and potentially profitable food products can be prepared from orange-fleshed sweetpotato. The use of sweetpotato as animal feed is also discussed.

**Topic 10: Marketing and Entrepreneurship.** The concepts of marketing, market orientation, entrepreneurship, and the 5 pillars of marketing (product, price, price, promotion and people) are discussed in relation to fresh sweetpotato roots and sweetpotato products.

**Topic 11: Gender and Diversity Aspects.** The importance of recognising gender and diversity issues in agriculture and sweetpotato systems is discussed. Situations where sweetpotato is grown as a female crop, and others where it is grown as a male crop, or grown by both men and women are presented along with the different constraints, needs and priorities of female and male farmers. Best practice suggestions are made for how gender can be incorporated into sweetpotato programmes.

**Topic 12: Monitoring of OFSP Dissemination and Uptake.** An explanation of the reasons for monitoring and the differences between monitoring and evaluation is provided. This is followed by a range of tools which can be used for monitoring the dissemination, performance and use of sweetpotato planting materials. In order to understand the long-term impacts and reach of sweetpotato training it is important that records are kept on who has been trained. These records can be used for follow up activities.

**Topic 13: Using the 'Everything you Ever Wanted to Know about Sweetpotato' ToT course.** Detailed programs for a 10 day and a 5 day learning-by-doing ToT course are presented. They describe: the topics to be covered each day; the intended learning outcomes; the sequential activities and their timing; and the materials and advanced preparations required. These programs are not intended to be prescriptive and we hope that facilitators will creatively adjust them to their participants needs.

**Topic 14: Reflections.** We hope that after field testing this manual trainers and participants will reflect on it and share their ideas for how it could be improved. Please send any suggestions you have to Jan Low [j.low@cgiar.org](mailto:j.low@cgiar.org) and where possible we will incorporate them into new editions.

# TOPIC 1: HELPING ADULTS TO LEARN

## IN

### EVERYTHING YOU EVER WANTED TO KNOW ABOUT SWEETPOTATO

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## Topic 1: Helping Adults to Learn

### 1.1 Becoming a skilled facilitator

It is well recognised that adults learn best through practical hands-on experiences with issues that are clearly relevant to their lives; through discovering essential details themselves and sharing and comparing practice notes and observations with their peers.

This training manual and course support a discovery-based/ experiential/ learning-by-doing approach to farmer learning. Each topic in the manual is supported with a suggested plan of how it could be worked with during a training course and detailed step-by-step ideas for learning-by-doing activities about it. However, the successful delivery of such an approach requires an open-minded facilitator with a deep commitment to improving farmers' livelihoods through guiding the participants' own learning processes.



This *'Everything you ever wanted to know about sweetpotato'* training course is designed to provide opportunities for farmers to carry out hands-on practical activities themselves, and to then compare these to their own and other farmers' typical sweetpotato management practices. In this way they become practical experts able to compare different practices and adapt and adopt those that best fit their needs. Where possible the learning should be based on-farm to make it as realistic as possible. The trainer/ facilitator's role is one of carefully balancing their encouragement of farmer discovery and discussion with their sharing of other relevant sweetpotato knowledge and practices, but taking care to avoid a top-down lecturing/ instructive situation becoming the norm.

Where facilitators are fortunate enough to be based close to the farmer communities with whom they work, they can over time facilitate strong on-going learning processes. Farmer experimentation with different sweetpotato management practices will likely need to occur over several seasons for farmers to see for themselves the differences and costs and benefits of using various practices in their own situation. Group work and sharing of learning by farmers can also help with this. By experimenting, farmers are generating their own experiential learning materials which will stay with them far longer than if they passively listen to the words of a trainer. These farmers will also use their first-hand experiences to then share their learning and discoveries with other farmers. The emphasis of this training is on empowering farmers to implement their own sweetpotato management decisions to best meet their own unique needs.

Good trainers are typically those people whose deep enthusiasm for and understanding of the subject shines through in all the activities, but who do not dominate the activities. Their enthusiasm is infectious and these trainers realise how important it is that each participant finds out something relevant about the topic themselves, something which will help them somehow in their own lives whether it be through gaining a new practical skill, a deeper understanding of why something is important, or finding out how they can access information to help with developing solutions to their challenges. When trainers feel deeply about the subjects that they teach, trainees will respond in kind. The emphasis must be on the trainees' learning.

*"When you hear you forget,  
when you see you remember,  
when you discover you own it for life"*

Some important criteria to consider when selecting a trainer or facilitator or when trying to improve one's own training/ facilitation skills are described below.

### **A good facilitator will:**

- have respect for all the participants in the training and accept them as equal partners in the learning and problem solving
- have strong participatory facilitation skills (including experience in facilitating learning-by-doing processes, an understanding of the importance of participants' ownership of the learning process and issues addressed, an ability to create a conducive learning environment, and good communication, observation, listening, probing, problem posing, negotiating and summarising skills);
- be gender sensitive, aware of how gender affects communications and interactions in all situations, ensure that gender issues are addressed in all areas of the training and that men and women trainees are respected and fully included in all aspects of the training;
- have strong sweetpotato technical skills based on practical experience as well as an understanding of the supporting theories;
- make preparations for all the learning-by-doing activities well in advance in order to deliver a good training experience;
- be: creative, flexible, well-organized, good at listening, respectful, patient, transparent, collaborative, committed, trustworthy, friendly, relaxed, impartial, well-presented, able to read participants' non-verbal body language and aware of the signals emanating from their own body language, good at delegating, confident, effective at time keeping, skilled in using a large enough font size for participants to read, able to explain things clearly and meaningfully, interested in careful observation, able to probe and guide group discussions and activities keeping them lively in order to achieve their intended outcomes without dominating them, able to intervene or stand back at appropriate moments, able to prevent individuals from dominating;
- be curious about why farmers are not already practicing better sweetpotato management, and skilled in listening carefully in order to learn about the farmer's analysis and reasons, and not assume they have a superior understanding of the farmer's situation;
- assist the participants in identifying sweetpotato opportunities which are relevant and appropriate for their own situation, and ways they can continue learning after the training.

### **A good facilitator will not:**

- be a top-down instructor who thinks their knowledge and experience is superior to that of the participants;
- be arrogant, intolerant, impatient, late, careless, disorganised, or immoral;
- reduce participants' hands-on learning opportunities by delivering overly long presentations and lectures inside the training room;
- leave the planning of the training session and activities to the last minute;
- pretend to know about things s/he does not.





**Weak facilitator / Strong facilitator**

*Use practical discovery-based learning-by-doing methods to engage the participants*

Facilitators/ trainers can improve their facilitation skills through:

- being curious and finding out about the different farmers' sweetpotato management issues and existing constraints to improving their sweetpotato enterprise;
- organising and practising all the planned activities well in advance of the training course, and making any adjustments/ improvements as necessary;
- ensuring the learning outcomes and activities are meaningful, fun and clear to participants;
- encouraging the participation of all participants especially women who often tend to be quieter and more hesitant to join in than men;
- showing interest in each participant as an individual in order to motivate them;
- building rapport;
- using the right language;
- creating an open and non-threatening learning environment throughout the training;
- being aware of and respecting cultural norms;
- keeping abreast of relevant training opportunities, technologies and knowledge;
- being open to constructive criticism and suggestions;
- mastering the balance between staying with prepared activities and exploring subjects that arise spontaneously to give both structure to the training while at the same time taking the opportunities that arise to add relevance and vibrancy;
- learning by observation of and discussion with other trainers/ facilitators;
- regularly self-evaluating and reflecting on ways to improve their own practice, and then courageously trying new ways of facilitating activities. *Note: a sense of inadequacy can be a great gift, as it provides trainers with an opportunity to change and grow;*
- being patient and understanding that like everything facilitation skills take time to learn and require practice;
- re-enlivening their thinking and viewing the subject and their trainees in a new way. To do this effectively, they need to see themselves and let their trainees see them as a learner, not simply as a teacher. They need to model for the trainees a curious active interest in learning – a willingness to enter into new discussions, to consider topics from different perspectives, to find new understandings in everyday experiences, and be willing to train/ facilitate in a new way, where the learning curve is steep and the risk of failure is pronounced. This is the mark of a good trainer. When they are on the edge and at risk, they are more alert and engaged.

Prior organisation



Training/  
Learning

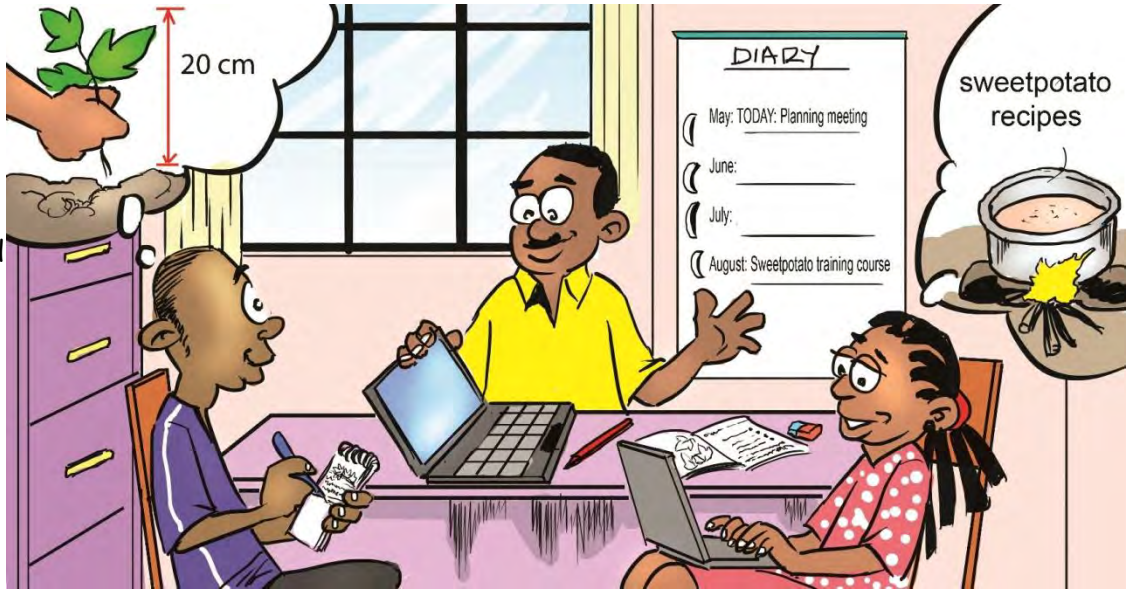


Evaluation/  
What was  
learnt?



**Weak organization and facilitation**

Advanced  
planning



Training/  
Learning



Evaluation/  
What was  
learnt?



## 1.2 Planning a training course

### 1.2.1 Successful training requirements

- Well trained and committed facilitators.
- Careful ground work prior to the training to ensure a good understanding of local sweetpotato problems, practices and resources by the facilitator and local authorities, leaders and other key stakeholders.
- Participants who are dedicated and interested in learning more about sweetpotato. This requires careful selection of participants.
- A flexible and fun training programme based on the needs assessment of participants and the overall aim and intended learning outcomes of the sweetpotato training.
- Well thought through and well-organised practical learning-by-doing opportunities.
- Adequate resources, logistical support, training materials, equipment and advanced planning.
- Committed long-term supervision, monitoring and evaluation of the sweetpotato training activities.
- Realistic and resourced plans for further trainer to extension agent, extension agent to farmer, and farmer to farmer training and follow ups.

#### Key steps for good change agent or farmer training

1. Needs assessment
2. Setting the learning outcomes
3. Planning and resources
4. Delivery using a learning-by-doing approach and including assessment of learning
5. Course evaluation
6. Reflection on opportunities for improving the course
7. Scaling out and up activities
8. Follow up and checks on long-term achievement of learning outcomes

### 1.2.2 A good facilitator

Adults learn best through practical hands-on learning relevant to their lives. The facilitator's job is to organise and support discovery-based learning opportunities for the participants. Section 1.1 describes characteristics of good trainers and suggestions for how one can improve one's facilitation skills.

An important attribute of a good facilitator is being gender sensitive and aware of differences between trainees. There are many factors that encourage or inhibit people's participation such as language, experience related to the topic, and experience of speaking in public. Power relations related to people's age, gender, social and economic position and their hierarchic position in their profession will also influence how they interact with the other participants. A facilitator must be gender aware when selecting participants and when facilitating. For example, using gender neutral language (e.g. saying entrepreneur rather than business man), ensuring that women have equal opportunity to express their views, using examples that represent both men's and women's perspectives and experiences and avoiding gender stereotyping. A gender sensitive facilitator also needs to understand how gender issues are related to all aspects of and all topics in the training, and be able to weave gender issues into each topic. Gender and diversity aspects are highlighted in each topic in this manual, and Topic 11 provides an overview of gender and diversity and examples of how it is relevant at each stage of the sweetpotato value chain.



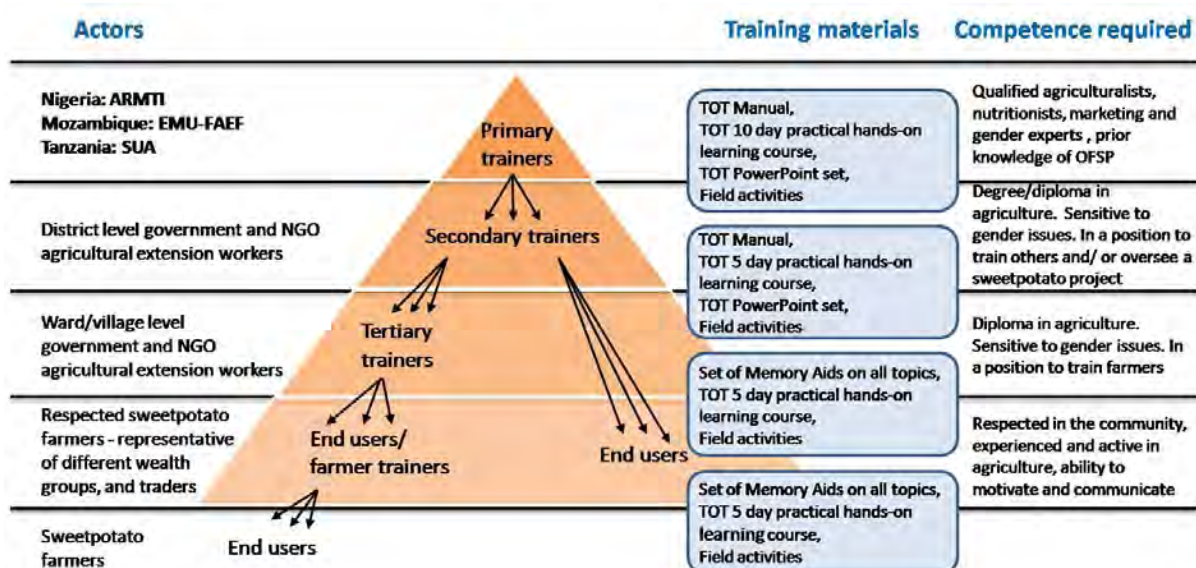
### 1.2.3 Pre-training needs assessment, learning outcomes, and stakeholder awareness raising

**Aims:** The Reaching Agents of Change (RAC) project’s overall aims for this ‘Everything you ever wanted to know about sweetpotato’ training course and manual are: *to build the capacity of implementing agencies to implement technically strong cost-effective interventions that drive uptake of orange-fleshed sweetpotato.*

Geographically RAC is initially focusing on three key sweetpotato producing countries in Years 1 and 2 (2012 and 2013): Nigeria, Tanzania and Mozambique, and within those countries on the main sweetpotato producing areas. In subsequent years it will include Ghana and Burkina Faso though to a lesser extent.

Before starting any training it is important that an assessment of the target audiences’ training needs is done. This helps tailor the training to the participants’ needs, making it as relevant, interesting and useful to them as possible. In the case of the RAC ‘Everything you ever wanted to know about sweetpotato’ training, there are different types of target audiences (see Fig 1.1) e.g. primary trainers (the host training institute identified in each country), secondary trainers (the district level agricultural and nutrition extension and NGO staff), tertiary trainers (the field level extension and NGO staff) and end users (female and male, poor and medium wealth sweetpotato farmers) some of whom will become farmer trainers, and they all have slightly different training needs. The RAC programme will focus on the primary and secondary trainers. These trainers will then train others within their own programmes/ projects.

**Figure 1.1 Overview of the RAC project’s training pyramid, showing the different levels of trainers**



**Pre-training needs assessment:** Whichever audience group the training is focused on, there is a need to find out what the main constraints to farmers improving their sweetpotato production, utilisation and marketing are currently perceived to be. It is important to discuss this issue with different types of people in the community where the training will take place, e.g. older and younger farmers; female and male farmers; poorer, middle income and wealthier farmers; field and district level government extension officers; field level NGO staff; traders; local leaders; farmer organisations; and researchers etc. It is also helpful to visit different types of farmers’ sweetpotato farms and post-harvest systems so they can show you the actual situation and problems they currently face. These discussions can be done with focus groups and/or individuals using semi-structured checklists, or a questionnaire could be developed and may form part of the baseline monitoring system of the project as well as the training needs assessment.

While gaining an overview of the farmers' (end users) sweetpotato knowledge and skills gaps, you can also use a similar approach to identify what the training needs are for the other trainers (tertiary, secondary and primary trainers) who will be helping deliver and scale-out the training activities. Using these findings you can develop your training course's draft learning outcomes to address these knowledge and skill gaps and to help achieve the overall aim. It will still be necessary to verify these draft learning outcomes with the participants at the start of the training programme, but good groundwork is crucial in helping to understand and plan a meaningful training programme, and can save a lot of time and resources.

**Learning outcomes** are broad goals that describe what the learners are supposed to know, understand and/ or be able to do after the learning, e.g. the intended end point after a period of engagement in a specified learning activity.

*For example:*

At the end of the *'Everything you ever wanted to know about sweetpotato training'*, the tertiary trainers (field level extensionists and NGO staff) are expected to:

- understand the key aspects of sweetpotato production, utilisation and marketing relevant to their geographical area
- be able to demonstrate key skills such as: selection and preservation of clean sweetpotato planting materials, how to multiply sweetpotato planting materials in order to have the amounts needed at the right time, sweetpotato crop and pest and disease management, and preparation of different recipes made from sweetpotato
- know about the importance of good nutrition and Vitamin A in the human diet, and foods that can be used to avoid Vitamin A deficiency
- understand how gender roles and responsibilities affect sweetpotato production, utilisation and marketing
- know how their farmer clients' sweetpotato systems could be improved
- be able to use learning-by-doing activities in delivering their own sweetpotato training course

**Stakeholder awareness raising:** To maximise the impact of the training; it is important that in addition to the farmers, key local stakeholders are also aware of the training programme's aims and plans, and recognise in what ways it is relevant to their own goals. The needs assessment will have created an opportunity to meet these key stakeholders, it is important that you keep them updated on plans and activities so that they build ownership and understanding of the training programme from its early stages.

#### 1.2.4 Pre-training trainers' planning and practice event

If the project has sufficient resources it is a good idea to organise a pre-training event for the trainers' to plan, refresh, discuss and practice their skills for delivering the training course. This pre-training event should ideally occur a few months in advance of the course in order to allow the trainers to work out exactly what field and practical activities they need and get them planted and organised in advance. However, if the course organisers have already planted the fields for the learning-by-doing activities or plan to visit nearby farmer or research station fields then this pre-training can occur a few weeks prior to the training course.

The resources, the course length and coverage, and the facilitators' experience and familiarity with each other and the course will determine the necessary duration for this pre-training trainers' planning and practice event. It could range from a day up to 5 days.

This pre-training trainers' planning, refresher and practice session should aim to provide the *'Everything you ever wanted to know about sweetpotato'* course facilitators' with the space to:

- engage with and familiarise themselves with the materials and topics they are being asked to deliver during the course, including familiarisation with the relevant topic(s) in this manual and particularly the suggested training day activities and learning-by-doing activities;
- create session plans for the training day(s) they will be delivering;
- rehearse and refine practical activities and presentations for their topics;
- collaborate with colleagues who will be delivering the other topics in the training course to help improve the overall flow, continuity and style of the course;
- upgrade their knowledge on specific sweetpotato topics and relevant cross-cutting topics (e.g. adult learning, gender and diversity, monitoring and evaluation);
- refresh, experiment with and improve their facilitation skills;
- build trust and working relationships with the other facilitators involved in the course and the course organisers.

Key areas which could be covered in the pre-training trainers' planning and practice event are shown in Table 1.1. Include lots of hands-on learning opportunities in this event, so the participants' (and soon to be facilitators) confidence and familiarity in using such techniques increases.

**Table 1.1 Suggested topics to be covered in the pre-training trainers' planning and practice event**

Activity
Introductions – as an icebreaker
Objectives of and overview of the RAC project
Objectives of and overview of the RAC ToT Course
Objectives of and overview of this pre-training trainers' planning and practice event
Helping adults to learn
Brief summary of existing theory
Characteristics of a strong facilitator ( <i>use step 1 of Activity 1.4.1 role play, and the cartoons in 1.1</i> )
Review and practice of different learning approaches (e.g. brainstorming, group discussion, practical activities, open-ended questioning, group dynamics and energisers, case studies, role play, summarising, posters, presentation – see 1.2.7)
Learning outcomes – what they are, why we use them, how to develop them
Familiarisation with the suggested RAC ToT Course programme and intended learning outcomes (Topics 13 & 1)
Crash course in gender and diversity and how it is relevant in 'helping adults to learn' and throughout the sweetpotato value chain (Topics 11 and 1)
Crash course in monitoring and evaluation, and its relevance for training courses and sweetpotato projects (Topic 12, see 12.5 for forms)
Crash course in sweetpotato seed systems and their influence on the whole sweetpotato value chain (Topic 5)
Crash course in sweetpotato value chains or sweetpotato marketing and entrepreneurship (Topics 10 and 9)
Familiarisation with the ToT manual content and presentations for the different topics they will each be facilitating. Any alterations for the local context, while remembering that presentations need to be kept short.
Small group or pair work on planning and practising learning-by-doing activities (as described at the end of each topic in the ToT manual) for the different topics they will each be facilitating (e.g. Varieties (see 3.5), Nutrition (see 4.8), Pest and disease management (see 7.9), Harvesting and postharvest (8.9), Processing (9.8))
Rehearsal of at least 3 key learning-by-doing exercises. This enables the facilitator to practice facilitating the activity using the other trainers as participants, and enables the other trainers to become familiar with the activities throughout the RAC ToT course, and to provide constructive feedback on the activity. Try to ensure that at least one pre-harvest activity, one seed system activity, and one post-harvest, processing or marketing activity are covered. Use the actual settings which will be used e.g. sweetpotato field, laboratory or kitchen.
Preparation of detailed course sessions plans by the facilitators who will be delivering each topic. These should include: the planned timings, durations and intended learning outcomes of all activities planned, any advanced preparations needed, list of materials required. Session plans can be shared and improved in small groups.
Course evaluation – do this experientially using <i>Activity 1.4.3 adapted as necessary</i>

### 1.2.5 Selection of participants

In addition to working out *how many* training participants the budget can support, it is necessary to also think carefully about *whom* those participants should be in order to ensure that the benefits from the training are maximised and will continue to bring further benefits within the community.

For the training of secondary or tertiary trainers, the participants should:

- be active and practising extension or NGO staff;
- be willing to participate and work in groups;
- get on well with farmers and other extension or NGO staff and be willing and able to share their training experiences;
- be selected from a range of social groups, e.g. gender, age, public/private organisations;
- be located in a range of different locations across the existing or potential sweetpotato growing areas of the country so that there is a good spatial spread of trainees from whom others can learn.

Similarly, for the end user training, the participants should:

- be active and practicing farmers;
- be willing to participate and work in groups;
- get on well with other farmers and be willing and able to share their experiences;
- be selected from the targeted social groups, e.g. gender, age, wealth;
- ideally, be located in a range of different areas in the community so that there is a good spatial spread of trainees from who other farmers can learn.

Make sure you remember that not all farmers are middle aged, middle income, well educated men! Ensure that the way you design your training programme enables female farmers, young farmers and poor farmers to all benefit from it.

In order to support women's participation we need to ensure that the training programme:

- is offered equally to women;
- is designed in such a way that it does not prevent women's attendance (e.g. timing related to women's other household duties, duration);
- is promoted in such a way that women as well as men can see the opportunities (health, income and labour wise) that will arise from participating in the training;
- is designed to encourage the involvement and full participation of women from poorer and less educated backgrounds;
- uses trainers who are not only technically competent and up-to-date, but who are strong facilitators who empathise with the needs and aspirations of women, and do not hold fixed assumptions about gender norms;
- is designed to provide plenty of practical experiences in the use of sweetpotato knowledge and skills;
- at end user level is designed to ensure resources are used for village-based training and not just residential training;
- team are aware that for sustainable improvements, not only must benefits be targeted to rural women, but mechanisms have to be developed and put in place to ensure that these benefits can be retained by the intended beneficiaries;
- team are aware that the addition of participation criteria such as minimum landholding size, literacy and ability to purchase inputs act as potential biases against women and youth participation.

The course should also be attractive to youth who may not own land but who could offer some sweetpotato related services to their communities, and who demographically represent a large percentage of Sub-Saharan Africa's population. It may be necessary to run separate training courses for the poorest households in order to better meet their needs.



### 1.2.6 The training course programme

The training course programme must be designed to integrate the learning needs of the participants with the project's overall aims and to achieve the learning outcomes. Some helpful questions to aid this process are shown in the adjacent box.

Develop a programme for the whole training period and think through what learning activities you will facilitate in order to best achieve the learning outcomes.

During the training course keep a record of how long each activity actually took and what ideas you have for doing it differently next time. Use these reflections to improve the way you plan and facilitate in future.

A detailed programme for a 10 and for a 5 day Training of Trainers (ToT) 'Everything you ever wanted to know about sweetpotato' discovery-based learning course has been included as Topic 13 of this manual. It includes the intended learning outcomes, suggestions for which learning-by-doing activities could be used for each topic and their timings, linked presentations, and details of what materials and advanced preparations are required. Please study these suggested programmes (Topic 13), but note that they are not specific to your situation, and therefore will need adapting to meet the specific needs of your target audience. Below is a summarised version of the 10 day training programme (Table 1.2)

#### Helpful questions for designing a training course

- Who am I training? (Number of learners and their backgrounds)
- What am I training on? (Topic, the type of expected learning (knowledge, skills, behaviours))
- What do they know already about this topic? (Existing knowledge, misconceptions)
- How will I train them on the topic? (Which learning approaches, what length of time is available, how can we access field and farm situations and other practical learning opportunities)
- Which trainers will I use? (Who has a reputation as strong facilitator, who knows these topics, are they available)
- How can I build in flexibility to cope with unexpected needs? (Prioritising activities, so that if something takes longer than expected the key parts of the programme are still covered)

**Table 1.2 Summarised programme for the 10 day ToT 'Everything you ever wanted to know about sweetpotato' course**

Day	Topics		
1	<p><b>Introductions</b></p> <p><b>Participants expectations, agreement on learning outcomes</b></p> <p><b>Overview of importance of and uses of sweetpotato</b></p> <p><b>How gender and diversity is relevant for sweetpotato activities</b></p>		
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Day Topics	
<b>2 Different varieties of sweetpotato and their characteristics</b>	
<p><i>Intended Learning Outcomes: Participants will:</i></p> <ul style="list-style-type: none"> <li>- Understand key differences between sweetpotato varieties</li> <li>- Know about the key characteristics of at least 3 sweetpotato varieties suitable for their area/ region</li> <li>- Be able to help farmers identify the key characteristics they are looking for in a sweetpotato variety</li> <li>- Understand that varietal preference differs between people</li> <li>- Be introduced to why care during harvesting is important for sweetpotato</li> <li>- Know how to conduct a variety ranking test (using red, yellow and green cards)</li> <li>- Be experienced in conducting a taste test</li> </ul>	<p><i>Activities</i></p> <ul style="list-style-type: none"> <li>- <i>Activity 3.5.1: Spot the difference. (see 3.5.1) [2hr 45mins]</i></li> <li>- <i>Activity 3.5.2: Selecting sweetpotato varieties. (see 3.5.2) [70mins]</i></li> <li>- <i>Presentation 3. Natural diversity of sweetpotato; defining characteristics of different sweetpotato varieties; and methods for on-farm testing of different sweetpotato varieties and discussion. [45 mins]</i></li> </ul>
<b>3 Nutrition and OFSP</b>	
<p><i>Intended Learning Outcomes: Participants will:</i></p> <ul style="list-style-type: none"> <li>- Understand what a balanced diet is and why it is important</li> <li>- Know how OFSP can contribute to reducing Vitamin A deficiency</li> <li>- Be able to select appropriate local ingredients to prepare child-friendly, and nutritious OFSP meals</li> <li>- Understand the importance of the gender aspects of household nutrition</li> </ul>	<p><i>Activities</i></p> <ul style="list-style-type: none"> <li>- <i>Brainstorming: What is a balanced diet? [20 mins]</i></li> <li>- <i>Presentation 4a and Activity 4.8.1: How well balanced are our diets? What is good nutrition? (see 4.8.1) [10 &amp; 40 mins]</i></li> <li>- <i>Presentation 4b and Activity 4.8.2: Dining from a Vitamin A rich menu: Vitamin A, why OFSP helps combat VAD &amp; who is at risk from VAD. (see 4.8.2) [10 &amp; 20mins]</i></li> <li>- <i>Activity 4.8.3: Virtual porridge making. (see 4.8.3) [1 hour]</i></li> <li>- <i>Activity 4.8.4: Raising awareness and creating demand for OFSP. (see 4.8.4) [55 mins]</i></li> <li>- <i>Group discussion: Strengths &amp; weaknesses of tools and approaches. Are we integrating gender well? [45 mins]</i></li> </ul>
<b>4 Selecting, preserving and multiplying sweetpotato planting materials</b>	
<p><i>Intended Learning Outcomes: Participants will:</i></p> <ul style="list-style-type: none"> <li>- Be able to identify, select and conserve clean sweetpotato planting materials</li> <li>- Know about the principles of positive and negative selection and preservation of sweetpotato planting materials</li> <li>- Understand how to calculate vine multiplication rates and how varieties rates' differ</li> </ul>	<p><i>Activities</i></p> <ul style="list-style-type: none"> <li>- <i>Activity 5.10.1: Vines for planting: clean and multiplied. [2.5 hours]</i></li> <li>- <i>Presentation 5a. Sweetpotato planting materials, vine conservation, Triple S system, and net tunnels. [20 min]</i></li> <li>- <i>Discussion. Existing SP seed systems. [20 min]</i></li> <li>- <i>Activity 5.10.2: The Triple S system. [1.5 hours]</i></li> <li>- <i>Additional activities: Net tunnel (see Appendix 5.2) or tissue culture plantlets (see Appendix 5.1)</i></li> </ul>
<b>5 Sweetpotato pests and diseases and their management</b>	
<p><i>Intended Learning Outcomes: Participants will:</i></p> <ul style="list-style-type: none"> <li>- Be able to find field examples of the key pests and diseases of sweetpotato and explain and show the damage each can cause</li> <li>- Know a range of practical techniques for managing these key pests and diseases</li> </ul>	<p><i>Activities</i></p> <ul style="list-style-type: none"> <li>- <i>Activity 7.9.1: Field hunting for sweetpotato pests and diseases and learning how to manage them. (see 7.9.1) [85 mins]</i></li> <li>- <i>Presentation 7a. Lifecycles of key sweetpotato insect pests and diseases. [30 mins]</i></li> <li>- <i>Activity 7.9.2: Hidden damage. (see 7.9.2) [1 hr]</i></li> <li>- <i>Presentation 7b. Sweetpotato pest and disease management practices. [45 mins]</i></li> <li>- <i>Activity 7.9.3: Training others on key sweetpotato pests and diseases. (see 7.9.3) [1 hr 45 mins]</i></li> </ul>

<b>6 Sweetpotato production and crop management</b>	
<i>Intended Learning Outcomes: Participants will:</i>	<i>Activities</i>
<ul style="list-style-type: none"> <li>- Be able to help farmers set up a field experiment to compare different varieties or management practices</li> <li>- Understand the different stages of the sweetpotato crop cycle and the management implications of each stage</li> </ul>	<ul style="list-style-type: none"> <li>- <i>Activity 6.9.1: Comparing sweetpotato varieties and management practices:</i> Setting up a sweetpotato field experiment. (see 6.9.1) [3 hours]</li> <li>- <i>Activity 6.9.2: Advanced planning:</i> Development of a sweetpotato agricultural calendar. (see 6.9.2) [75 mins]</li> <li>- <i>Presentation 6.</i> Sweetpotato crop cycle. [45 mins]</li> </ul>
<b>7 Planning a planting material dissemination program</b>	
<i>Intended Learning Outcomes: Participants will:</i>	<i>Activities</i>
<ul style="list-style-type: none"> <li>- Understand all of the key steps, and bottlenecks that may emerge in planning a mass multiplication or DVM approach dissemination exercise</li> <li>- Practice designing a dissemination program for their area to reach 5000 households</li> <li>- Understand why it is important to monitor and evaluate activities</li> <li>- Practice monitoring the dissemination of planting materials</li> </ul>	<ul style="list-style-type: none"> <li>- <i>Presentation 5b.</i> Sweetpotato planting material multiplication and dissemination. [30 mins]</li> <li>- <i>Activity 5.10.3: Planning your multiplication and dissemination strategy.</i> Practical [3 hrs]</li> <li>- <i>Group discussion:</i> comparing the strategies for different scenarios. [20 mins]</li> <li>- <i>Activity 5.10.4: Working with DVMs.</i> [2.5 hrs]</li> <li>- <i>Presentation 5c.</i> Costing a dissemination plan [10 mins]</li> <li>- <i>Presentation 12.</i> Introducing M&amp;E. [20 mins]</li> <li>- <i>Activity 12.3.1: Where did it go? M&amp;E practice.</i> [30 mins]</li> <li>- <i>Homework problem:</i> dissemination costs</li> </ul>
<b>8 Harvesting, post-harvest management, and processing</b>	
<i>Intended Learning Outcomes: Participants will:</i>	<i>Activities</i>
<ul style="list-style-type: none"> <li>- Know about the main aspects of sweetpotato harvesting, post-harvest management and processing.</li> <li>- Understand how the processing and storage of OFSP affects beta-carotene content</li> <li>- Understand the importance of involving different groups in processing training and awareness</li> </ul>	<ul style="list-style-type: none"> <li>- <i>Activity 8.9.1: Increasing profits through storing fresh sweetpotato roots.</i> Field exercise. (see 8.9.1) [2hrs]</li> <li>- <i>Activity 8.9.2: Effect of sun-drying and storage on beta-carotene content of OFSP.</i> (see 8.9.2) [30 mins]</li> <li>- <i>Presentation 8.</i> Harvesting &amp; postharvest [45 mins]</li> <li>- <i>Activity 9.8.1: Substituting sweetpotato flour for wheat flour in a chapati recipe AND Making sweetpotato juice (9.8.2) AND Making sweetpotato flosses. (9.83)</i> [2h 30m]</li> <li>- <i>Presentation 9.</i> Processing. [45 mins]</li> </ul>
<b>9 Marketing and entrepreneurship</b>	
<i>Intended Learning Outcomes: Participants will:</i>	<i>Activities</i>
<ul style="list-style-type: none"> <li>- Be familiar with the concepts of marketing and market orientation</li> <li>- Understand the 5 pillars of marketing</li> <li>- Understand the opportunities and challenges in sweetpotato fresh root and processed product marketing</li> <li>- Explore gender issues along the value chain</li> <li>- Be aware of how to select an appropriate processed product</li> <li>- Know how to calculate marketing margins for fresh roots and processed products</li> </ul>	<ul style="list-style-type: none"> <li>- <i>Activity 10.10.1: Market trip.</i> (see 10.10.1). [4.5hrs]</li> <li>- <i>Presentation 10a.</i> Marketing and entrepreneurship and gender aspects. [20 mins]</li> <li>- <i>Activity 10.10.2: Calculating your profit margins.</i> (see 10.10.2) [45 mins]</li> <li>- <i>Activity 10.10.3: The 5 Pillars of Marketing.</i> (see 10.10.3). [55 mins]</li> <li>- <i>Presentation 10b.</i> The 5 pillars of marketing, and how to select your product. [20 mins]</li> </ul>
<b>10 Planning to train others on 'Everything you ever wanted to know about sweetpotato'</b>	
<i>Intended Learning Outcomes: Participants will:</i>	<i>Activities</i>
<ul style="list-style-type: none"> <li>- Understand and have developed the draft learning outcomes and approaches, training materials and draft logistics plans of the sweetpotato training courses they will be delivering</li> <li>- Be able to deliver a 5 day training on 'Everything you ever wanted to know about sweetpotato'</li> </ul>	<ul style="list-style-type: none"> <li>- <i>Activity 1.4.1: Practising being learning-by-doing facilitators.</i> (see 1.4.1) [2hr 30 mins]</li> <li>- <i>Presentation 1.</i> Helping adults to learn and the 5 day ToT programme (see Topics 1, 13 &amp; Appendix 1.3) [1hr]</li> <li>- <i>Activity 1.4.2: Ideas for additional sweetpotato learning-by-doing activities.</i> (see 1.4.2) [1hr 20 mins]</li> <li>- <i>Activity 1.4.3: Evaluating a training course.</i> (see 1.4.3) (sweetpotato knowledge exit test (Appendix 1.2) [1hr]</li> <li>- Presentation of certificates [1hr]</li> </ul>

### 1.2.7 Working with practical learning-by-doing activities

Experience suggests that adults and particularly farmers typically learn-by-doing, and that they must be able to relate to the topic being learnt about. We use the terms experiential learning, discovery-based learning and learning-by-doing interchangeably. These learning processes are cyclical and on-going, the learner has an experience, reflects on the experience, and from this reflection gains new insights or ideas to test. These new ideas are then tested, followed by further reflection, and so the process continues in a cycle of experience, reflection, new ideas, experimentation, experience, reflection etc. This process which builds on the learner's own experience and understanding helps to empower them in solving problems and making decisions based on their own unique experiences, situations and needs. These skills can then continue to be used in all aspects of their livelihoods.



Smallholder farming systems are diverse. One-size-fits-all type recommendations should therefore be avoided. The facilitators/trainers need to work with farmers in supporting them to test, assess and adapt a range of options within their specific local conditions and then these farmers can continue refining those that are useful to them and finding out about new options. If participants are to learn experientially they need to learn to observe carefully and over time, so that they pick up the dynamics and patterns in the processes they are studying as opposed to seeing things as unchanging fixed forms. Drawing and repeated observations, as well as group discussion of observations are useful techniques for training these skills.

Key learning approaches used in discovery-based learning include:

**Practical activities:** use practical activities that are as close to real-life situations as possible. Visit a nearby farm, practice: land preparation; taking healthy cuttings; planting spacing; roguing out virus infected materials; weeding and hilling up; curing; careful harvesting and transporting. Ask the farmer about the practices and varieties s/he uses and why. Visit a market find out about which sweetpotato varieties are sold and why, assess different marketing practices and profit margins. Or in a training room prepare a range of sweetpotato dishes, practice fresh root and dried chip storage and utilisation. The facilitator can help the participants by probing using open-ended questions, 'Why do you think the farmer has done it that way?', 'Where has this come from?' – *see below for more on using open-ended questions*. The facilitator should ensure that the process of collecting and interpreting results from the practical activity is built into the learning, e.g. groups of participants could harvest two or more different varieties and compare the quality and quantity of the roots and leaves from each, discussing their pros and cons.



**Group sharing and discussions:** whilst hands-on activities are a central part of practical activities, interacting with others and seeking other people's perspectives and knowledge about the issue are also important. As adult farmers, the participants will all have many years of experience in dealing with sweetpotato issues. Shared discussion of this experience can be very helpful in enabling them to see the problem from different angles and find ideas for new solutions to test. The facilitator can

ensure that all participants put their ideas and experiences forward, and can break the participants into smaller groups to work on different topics and then share their findings. The participants should be challenged to think about who they can ask about different aspects of their problems. For example, they could seek out a trader who frequently rejects sweetpotato roots based on their low quality and asking that trader to show them what the problems are, and to share what criteria s/he uses regarding root quality. They could seek out a farmer who typically harvests a lot of sweetpotato and find out what sweetpotato management activities s/he does differently.

**Open-ended questioning:** answering participants' questions with a further question helps encourage them to develop their own analysis and understanding and problem solving skills. An open-ended question is one where the answer has to be informative, and can-not be a simple yes or no. An easy way of ensuring your question is an open-ended question is through using one of the 'little helpers' – *why, how, when, which, where, who, what* – at the start of the question. 'When does it start happening? What problem does it result in? Where is it coming from? How do they get inside?' The respondents will then have to respond with further information which helps you and them build up a broader understanding of the issue which will help in analysing, reflecting and planning what to do.

**Brainstorming:** is a process for getting creative inputs and ideas from a large group of people about a topic or problem. It can be useful in helping to prevent influential individuals from dominating the process and intimidating quieter participants, and can remove participants' fears of feeling they have to conform to the group or leader's view. Give participants a few minutes to individually think about the focal issue, and to write down their key points on cards (or for those not used to writing to explain to a scribe). Only one point should be written per card. Everyone is then asked to stick their cards up on the wall. The cards can then be read out and organised into groups of similar issues. Sorting of the cards stimulates discussion, and the sorted cards provide a good summary of the discussion. Some of the ideas on the cards will spark further ideas, which participants might want to add by writing extra cards, or once the cards are organised an obvious gap may reveal itself. The brainstorming approach aims to jolt people out of their normal way of thinking, and expose them to other people's perspectives on the issue. It is important that during the brainstorming there is no criticism of ideas, as the intention is to open up possibilities for further investigation and discussion.

**Group dynamics and energisers:** the facilitator needs to help participants feel at ease and open to express their experiences, questions and problems. This is particularly the case when participants do not know each other. While the facilitator's manner and body language will help in building rapport and connecting with the participants, encouraging open communication, short games and exercises can also be used to help participants interact, think more creatively about specific issues, relax and work well with each other. Group dynamics exercises develop group cohesiveness and problem-solving skills, and encourage collaboration and creativity. These activities generally begin with an introduction by the facilitator who sets up the problem or challenge for the group to solve. Some are physical and active while others are brain teasers. The exercises should be fun while providing experience of using teamwork to solve specific problems. Energisers can be used when participants seem sleepy or tired, to get them moving and to give them more enthusiasm. They can also work well to create a natural break between different activities. Some examples of energisers and group dynamics are given in Appendices 1.1a and 1.1b.



**Case studies, role play, storytelling and problem solving exercises:** A case study is usually a full description of a realistic scenario, such as a common or emerging sweetpotato problem. Working individually or in small groups can help participants develop: solutions for addressing the problem; skills in identifying problems; analysis of a situation; data gathering skills; an understanding of the issue from someone else's perspective; and experience in communicating their ideas and opinions.

Role play or the acting out of a situation can be combined with case study as a way of exploring the issues involved in complex situations with no single right answer. It can be treated as a rehearsal for a real-life situation, an opportunity to practice one's skills and to be aware of other people's perspectives regards a situation. Songs, storytelling, dances, and drama can also be used creatively for communicating ideas or problems and stimulating exploration and discussion. Such oral presentations are often used for passing information on to many people, and could be used by participants to summarise each day's learning.

**Posters:** are a good way to explain a process to participants, or to show examples of different kinds of sweetpotato varieties, storage systems or problems etc. Posters should combine graphics and text and if possible be colourful and simple.

**Summarizing:** reviewing the learning at the start and finish of each day is important. This should preferably be done by the participants, so that the facilitator can use these sessions as a way of monitoring the understanding and learning of the participants regards the topics that have been covered during the session. It is important to find ways of ensuring all participants participate in this otherwise one is only aware of the more confident students' learning progress. You could ask specific people to summarise the session, or ask all the participants to think of three things they have learnt and then go round the room asking each participant to mention one thing. Feedback and evaluation sessions are important, and the facilitator should ask the students if there were any topics they feel they did not clearly understand or which they want further explanations of or practice in.



**Presentation:** If presentations are used during the training, it is important to think about:

- what the intended outcomes of the presentation are,
- how will the presentation fit with the other activities you have planned,
- what length should it be,
- what language you are going to deliver it in,
- how you are going to make it relevant to the participants so they are not just passive listeners,
- at which points will you invite questions,
- will participants take notes during the presentation or be given copies of the presentation.

We all know how boring it is to sit through a set of text only slides. Try and include diagrams, photos, sketches or cartoons as much as possible to help visually stimulate the participants during the presentation. Practice presentations in advance of delivering them, to work out how long they take (try and keep them under 20 minutes), whether they flow well and whether any aspects need to be cut out. Practical training activities can be enhanced when students understand the principles which underlie them, so presentations are a good opportunity for covering some of these principles especially ones which are difficult to actually see during a practical activity e.g. the development of the different insect lifecycle stages inside a sweetpotato root. However, presentations do not have to be given before a practical activity. They can often be more effective after the practical activity when the participants' interest in the subject has already been increased and they have observations and questions that they are trying to understand more about.

### 1.2.8 Adequate resources and advanced planning

Careful advanced planning can save hours of time later on. In addition to the needs assessment, development of the learning outcomes, training programme and activities, and selection of the participants, the facilitator also needs to think about the timing and duration, the venue, field sites, advanced set up of experimental plots, equipment and training materials, the transport and food.

**Timing:** Ideally an agricultural training course should be run just prior to the field or post-harvest activities it focuses on occur. However, when the course is very broad such as this *'Everything you ever wanted to know about sweetpotato'* course it is likely to be advantageous to run the course prior to the planting season, so that the crop cycle is then followed. Alternatively the course may be split into several sections and each part delivered just prior to the natural time when these focal activities are done or prior to when the focal problems typically occur. This will help ensure that the participants are already beginning to think about the activities and that the knowledge and skills they practice during the training can be applied fairly immediately in their own fields.

**Duration:** The length of the training course will depend on the needs assessment, budget and programme. The suggested secondary trainers ToT programme included in this manual is 10 days long, and the suggested tertiary and end users course is 5 days long. This training may happen in one solid block or if the facilitator is based close to the participants it may be better to cut the programme into a series of training days which each happen just before the field timing of the activities they cover. Residential training courses need to budget for participants' accommodation; and it should be recognised that some participants (particularly women) may be prevented from attending a residential course. The advantages of residential training are that participants remain at the training centre so should not be late in the mornings and may form stronger bonds and therefore be in a stronger position after the course to support each other and train other farmers.

**Venue and field sites:** When choosing a venue think about what activities you want to do there and how big the training room needs to be, how the participants will safely reach and operate within the venue, whether there is electricity if required, whether you can stick up posters and flip charts on the walls and move the tables and chairs around, whether the food is good, whether childcare arrangements can be accommodated, and whether the venue offers good value for money. It is ideal if the venue can be within or next to the participants' community so that the relevance of the sweetpotato learning is evident. Visits to fields and farmers homesteads need to be planned, arranged and if possible pre-tested in advance.

**Trainers:** After developing the training course programme (based on the needs assessment, aims and resources), the organiser/facilitator will need to identify whether any of the planned training topics would benefit from delivery by someone other than him/herself. If so, they need to identify a facilitator with strong facilitation skills who has expertise in the focal topic (e.g. nutrition, pest and disease management, planting material conservation etc.). It is worth investing time well in advance of the course to discuss the planned programme and particularly the importance of using a learning-by-doing approach with any other trainers who will be involved. This can help avoid trainers arriving unprepared or with 200 slides to present, instead of having thought through a practical hands-on learning opportunity for the trainees (see cartoons in section 1.1). As soon as the course dates are fixed, ensure the programme is shared with all the trainers and explain that you wish to avoid any last minute changes to the programme as it is designed to flow in a logical learning order for the participants. If it is possible to involve the other trainers in planning the full programme, that will help strengthen their ownership of the course and their understanding of the approach and importance of sticking to the planned sessions. If not, then a pre-training trainers' planning and practice event should be arranged (see 1.2.4).

**Advanced activity preparations:** Field visits and activities need to be thought about in well in advance of the course so that fields can be prepared or found to ensure the crop will be present and exhibiting the necessary stages and symptoms for the practical training experiences. Details of suggested advanced preparations required for this course are given in Topic 13.

### 1.2.9 Follow-up and long-term monitoring and evaluation

**Follow-up visits:** If resources allow, ask one group of participants who are based close to each other, to organise and host a follow-up sweetpotato field day between 4 and 12 months after the training so the participants have had time to experiment and reflect on what they have learnt, and any changes they have made or tried to make.

The follow-up field day will provide an opportunity for those participants who received the training to demonstrate and share information about what changes in their sweetpotato practices they have made since the training, and what the result of these changes has been. It also provides an opportunity for them to highlight other problems or ideas that may not have been gone into in great detail during the training, and to learn from each others' sweetpotato practice. This activity could also form an important part of the monitoring and evaluation of the training, regards assessing behavioural changes, outcomes and reasoning. By letting time elapse between the training programme and this follow-up field visit, the participants would also have been able to reflect more on the training itself and as a result might be able to suggest ideas for how it could be improved for the benefit of future training participants.

If the trainee farmers are spatially too distant from each other to easily organise a follow-up field day, but the facilitator is able to visit the farmers individually this should be done during the next year. This visit will enable the facilitator to learn about whether farmers are putting any of the sweetpotato training topics into practice on their own farms, and if not to find out why not. It will also allow the facilitator to answer the many questions that the farmer is likely to have thought of since the training and returning home to try to apply their learning on their own farming system. Whether the follow up is done via a field day or through individual visits, it is important that written records are made of such visits to act as a monitoring and learning tool for future '*Everything you ever wanted to know about sweetpotato*' training.

**Monitoring:** Careful records need to be kept about who has been trained (including name, gender, age, wealth group, household location), and when and where it happened (see Forms 12.5.5a and 12.5.5b in Section 12.5.5 of this manual). These details should be included in the facilitator's report at the end of the training, and are very important for monitoring, follow-up and impact evaluation activities. These details are needed in order to keep track of which extension and NGO officers have received training and who they have then trained, on what, and in what ways. Setting up a simple system to record this will help in keeping track of how many extensionists/ NGO staff and farmers the sweetpotato training has reached. It can be useful for follow-up activities and for evaluating how useful the training has been to these extensionists/NGO staff and farmers, and what aspects need greater emphasis or support and so can be improved in future training activities.

**Evaluation:** Participants and facilitators can evaluate whether their own expectations were met during the training course. Most training courses include a short evaluation session at the end of the course, a typical example of an evaluation form is given in section 12.5.5 (see Form 12.5.5c). However, it should be noted that an evaluation like this typically evaluates just the delivery, content and organisation of the training course, and does not usually go further into assessing actual learning outcomes. Some preliminary assessment of the learning outcomes could be done using a questionnaire on sweetpotato issues at the beginning and end of the training course (see Appendix 1.2), and through practical observation of the participants during the course. If resources allow it is much more effective to carry out an evaluation of the learning outcomes and impacts some months or years after the training so that participants' use of new sweetpotato knowledge and skills and behavioural changes can be evaluated.



### 1.2.10 Scaling-up and out the learning

A training course for 30 participants is an expensive investment, and so it is important to think about how to maximise the impact of that investment. This could be through developing a plan so that those who were trained then train others or share what they learnt with others (scaling out) (see Fig. 1.2), and/or it might involve attracting the attention of regional or national level stakeholders who might be interested in supporting similar training courses in other areas or through their own

organisation's activities (scaling up). It is a good idea to ask the training participants to create a 'Training Action Plan' providing details of who they plan to train, what the training will contribute towards, who will fund that training and when it will happen. An example of a training action plan form is given in Appendix 1.3.

Figure 1.2 Scaling out the training and learning



### 1.3 Gender and diversity aspects of helping adults to learn

A thorough discussion of gender and diversity aspects in relation to sweetpotato is presented in Topic 11. Key gender and diversity issues relevant to helping adults to learn include:



- Training is not something that happens in a vacuum, it builds on the prior knowledge and experiences which women and men bring with them when they take part in training programmes. When designing a training course and selecting the facilitators it is important to ensure that this is done in ways which will help women and men from the focal range of cultural and educational backgrounds learn best.
- There are five key areas where gender and diversity aspects need to be included in the planning, implementation and monitoring of training courses, these overlapping areas are: the content; the training approaches and activities; the language and communication; the framework conditions/ logistics; and the gender awareness competence of the facilitators.
- During the pre-training needs assessment it is important to understand what experiences or prior knowledge potential participants have and whether this differs between women and men. In the case of a sweetpotato training course it would be useful to understand: the typical activities and responsibilities of both men and women across the day and the year; who controls and has access to which resources, and how decisions affecting sweetpotato activities (e.g. land, planting time, source of planting materials, varieties, crop management, labour availability, nutrition and food preparation, processing, marketing, and income) are made.
- The course organisers may wish to set gender and diversity targets, such as: an equal number of men and women attend the course and are proportionally representative of the wealth or ethnic groups in the area; speeches by made by different groups of participants

are approximately the same number and length (e.g. one group is not dominating the discussions); course advertising and materials used for the course are produced in gender-neutral language; the issue of gender and diversity is taken up as a central theme in the course; the opinions/ attitudes of women and men to a defined (gender) issues have demonstrably changed during the course.

- It is important that training materials do not lump people together as though there was no diversity among them, or suggest stereotypes and roles which then make the participants feel limited. Training materials including documents, pictures, and examples should be checked to ensure they adequately present the social realities of both genders and work towards changes. If existing course materials do present farmers as a homogenous group or women and men only in stereotypical roles then it is important for the facilitator to point this out and discuss these issues in the training course.
- An interested facilitator will be able to recognise when they are using training approaches which are biased towards certain groups, and can then work to help widen participation and involvement of all the trainees present. For example, men may find it difficult to talk about personal matters with other men, or may be sceptical about some creative methods such as painting or role play. Women, may be shy when taking part in open debates, or avoid taking on leadership duties or presentations. These are learned behaviours, and are changing rapidly in most societies. By using a range of different training and learning approaches as described in Section 1.2.6, to achieve the training course's goals and the session's learning outcomes, the facilitator will help ensure that all participants participate and also are able to try something new or unusual.
- In training programmes which bring participants from a range of locations, or bring in external facilitators there are usually a range of mother tongue languages present. It is essential that oral translation services are organised to ensure that all participants can understand what is being said and can participate and contribute to discussions. Facilitators need to make sure they are using gender neutral language, e.g. business person and not business man; chairperson and not chairman etc.
- Establishing rules or norms at the beginning of the training programme can help support:
  - the use of gender-neutral language;
  - avoidance of stereotyping;
  - restrictions on the length of speeches by each person;
  - people to speak without being interrupted by others;
  - the awareness and avoidance of sexist language, disparaging or personal remarks;
  - discussion time;
  - feedback opportunities.
- During the planning of the training course it is important to think carefully about *who* the participants should be in order to ensure that the benefits from the training are maximised and will continue to bring further benefits within the community. Remember that not all farmers are middle aged, middle income, well educated men! Ensure that the way you design your training programme enables female farmers, young farmers and poor farmers to all benefit from it. Section 1.2.4 has more details on selecting participants.
- Potential participants can be accidentally excluded from participating in training programmes if care is not taken to ensure the acceptability to all participants of the:
  - the place and timing of training courses;
  - security arrangements (routes, access, public transport, overnight facilities);
  - goals of the training course are understood by not only the target participants themselves but leaders and others who influence their behaviour or have influence over their activities;

- information channels used for advertising and promoting the course;
  - compatibility with other livelihood activities e.g. family duties, farming activities
  - facilities (food, washrooms, transport arrangements, childcare, lighting, background noise);
  - cost.
- When selecting facilitators in addition to their knowledge of the subject it is also important to select facilitators with strong skills in the use of a range of participatory techniques. Such a facilitator will usually manage to create a beneficial learning environment with meets the requirements of the different participants. It is helpful if facilitators have both practical and theoretical gender skills, and actively look out for any gender issues arising. Gender and participatory techniques training should be included in any pre-training courses being organised for facilitators. If several facilitators are involved in the course, it is helpful to include both men and women facilitators.
  - In order to learn how to better meet the needs of different groups/types of participants, course evaluations need to ensure that the evaluation data can be easily disaggregated by sex, wealth, or ethnic group.

### 1.4 Ideas for training 'learning-by-doing' activities

These learning by doing activities have been designed to provide hands-on discovery learning opportunities for the participants of the 10 day 'Everything you ever wanted to know about sweetpotato' ToT course. We hope by learning about sweetpotato in a hands-on way, these trainers will then train others using a practical learning-by-doing approach.

The full 10 day ToT course programme is described in Topic 13 of this manual. The following activities occur on day 10 of the 10 day ToT course, an overview of day 10 is given below. However, we hope these activities will also be used by trainers as stand-alone learning activities and as part of other training courses.

Day	Topics	Intended Learning Outcomes	Activities
10	Planning to train others on 'Everything you need to know about sweetpotato'	<p><i>Participants will:</i></p> <ul style="list-style-type: none"> <li>- Understand and have developed the draft learning outcomes and approaches, training materials and draft logistics plans (timing, venue and field sites, participants) of the sweetpotato training courses they will be delivering</li> <li>- Be able to deliver a 5 day training course on 'Everything you need to know about sweetpotato'</li> </ul>	<ul style="list-style-type: none"> <li>- <i>Activity 1.4.1: Practising being learning-by-doing facilitators.</i> Practice in facilitating a key sweetpotato topic, and group work on the principles of giving and receiving constructive feedback (see <i>Activity 1.4.1</i>) [2hr 30 mins]</li> <li>- <i>Presentation 1: Helping adults to learn and familiarisation with the suggested 5 day ToT program</i> (see Topic 13). Discussion of it, and draft logistics planning for their delivery of it (see Appendix 1.3) [1hr]</li> <li>- <i>Activity 1.4.2: Ideas for additional sweetpotato learning-by-doing activities.</i> (see 1.4.2) [1hr 20 mins]</li> <li>- <i>Activity 1.4.3: Evaluating a training course.</i> Course evaluation (see <i>Activity 1.4.3</i>) (option to repeat sweetpotato knowledge test as exit test (Appendix 1.2)) [1hr]</li> <li>- Presentation of certificates [1hr]</li> </ul>

### 1.4.1 Practising being learning-by-doing facilitators

*Intended Learning Outcome:* Participants will:

- Be able to confidently facilitate discovery-based learning on the key topics on the 5th day 'Everything you ever wanted to know about sweetpotato' course which they will be facilitating
- Understand the preparation required to facilitate a meaningful learning-by-doing activity
- Receive constructive feedback from their peers on the strengths and weaknesses of their facilitation skills

*Timing:* 2 hours 30 minutes

*Materials:* Cards with the key topics from the 5 day training course written on them (e.g. conserving and multiplying planting materials including advanced planning, selecting clean planting materials, managing sweetpotato weevils, managing viruses in sweetpotato, processing sweetpotato, marketing sweetpotato, vitamin A and nutrition etc.), participants will need their 'Everything you ever wanted to know about sweetpotato' training manual, note books and pens; stickers/ post-its, flip charts, masking tape, marker pens, all the equipment that has been used during the training programme including ~100 sweetpotato roots some of which should be orange-fleshed.

*Suggested steps:*

1. Ask the participants to work in groups of four people. Assign half the groups to act out a short scene showing a bad facilitator, and the other half of the groups to act out short scene showing a good facilitator – they can choose any topic they like. Give them 5 minutes to practice and then 1 minute each to present. Then facilitate a 10 minute group discussion on the characteristics of good and bad facilitators, and the strengths of using an experiential/ discovery-based learning approach (*Sections 1.1. and 1.2 of this manual will be useful resources for this*). [20 mins]
2. Ask the participants to work in groups of four people. Explain that they are going to be given an opportunity to practice facilitating some of the key sweetpotato topics they will soon be training others on. Explain that each group will be given a card with one of the key sweetpotato training topics on it. They will need to use their memory, experience and the manual to develop and practice the facilitation of a relevant learning-by-doing activity related to the topic. They will be given half an hour to prepare, and then they should be ready to share a 5 minute role play of them facilitating that activity with the rest of the group. (Note: it is vital that at least two of the participants per group act as the facilitator during their role play, so they need to organise to share that role). [5 mins]
3. The facilitator should hand out the cards, and be available to help the participants if they have any questions. The participants will in their groups spend 30 minutes preparing and practicing the role play of them facilitating a learning-by-doing activity on the key topic they have been given. Remind them of the importance of at least two of them both playing the role of the facilitator during the role play. [30 mins]
4. Ask the participants to move their chairs into a semi-circle facing the 'stage' area. Explain that you are going to give out stickers, and after they have watched each groups role-play they are to quickly in their small group of 4, write down 2 strengths and 2 weaknesses about the facilitation skills or activity on stickers. These stickers will then be stuck on the flip chart for that group, before they watch the next group's role play. Remind them of the learning opportunities that arise from constructive criticism. Remind them also about the importance of working quickly, and that they should only put one comment per sticker, and write it clearly using marker pens. [5 mins]
5. Role plays (each group has 5 minutes), then a couple of minutes in-between for the audience to discuss and write on stickers 2 strengths and 2 weaknesses of the facilitation skills and activity. Note their needs to be a separate flip chart sheet for each small group the facilitator should prepare and paste them all up while the small groups are practicing their role-plays. [1 hour]

6. Give the participants 5 minutes to review all the strengths and weaknesses comments.
7. Ask each group to take the flip chart with the comments about their facilitation on it, and to review and group them, and discuss how they can build on the strengths and improve on the weaknesses. [10 mins]
8. Ask one group to share with the whole group their suggestions for how they could improve their facilitation and learning-by-doing exercise the next time. Facilitate further group discussion on this if necessary. [10 mins]
9. Ask the participants, how they took gender into consideration during their activity. [10 mins]

### 1.4.2 Ideas for additional sweetpotato learning-by-doing opportunities

*Intended Learning Outcome:* Participants will:

- Experience the steps involved in creating learning-by-doing activities
- Have created their own learning-by-doing activity for a key sweetpotato topic relevant to their location

*Timing:* 1 hour 20 minutes

*Materials:* Participants will need their 'Everything you ever wanted to know about sweetpotato' training manual, note books and pens; stickers/ post-its, flip charts, masking tape, marker pens, all the equipment that has been used during the training programme including ~100 sweetpotato roots some of which should be orange-fleshed.

*Suggested steps:*

1. Ask the participants to get themselves into new groups of 8 people (*e.g. not the same groups they did Activity 1.3.1. with*). Explain that you want them to spend 30 minutes, identifying and creating a new learning-by-doing sweetpotato activity which they feel would be useful when they train others. They will then have 5 minutes to describe or present the activity to the rest of the participants. [35 mins]
2. Ask each group in turn to share or show the learning-by-doing activity that they have planned to the rest of the participants. [*Note: the facilitator should take note of all ideas as they could be used to strengthen future training courses and edition of this training manual*]. [30 mins]
3. Facilitate a short discussion about these suggested activities [15 mins]

### 1.4.3 Evaluating a training course

*Intended Learning Outcome:* Participants will:

- have experience in evaluating a training course
- know how to analyse participants feedback in order to improve their facilitation and training delivery

*Timing:* 1 hour 15 minutes

*Materials:* Enough photocopies of the course evaluation form 12.5.5c for each participant, pens

*Suggested steps:*

1. Ask the participants to individually complete the course evaluation form, based on their experience of the ToT programme. [15 mins]
2. Then ask them to get into groups of 8 people. In their group they need to analyse the groups evaluation of the course, and to prepare a short summary of their responses to 5 of the questions on the form (they can select whichever five they like, but they must include some that had quantitative and some that had qualitative responses). [30 mins]
3. Ask each group to share their summaries with the rest of the participants [15 mins]
4. Facilitate a discussion regards the value of evaluating a course, and how they might evaluate what actual learning outcomes took place amongst those they train in the short, medium and long-term. [15 mins]

## 1.5 References used

The content of this topic draws heavily on materials which the author, Tanya Stathers developed recently for a similar section in a postharvest handling and storage management training manual for WFPs Purchase for Progress Programme (Hodges and Stathers, 2012). It also draws on the experiences of many other practitioners and the references below.

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Notes on **Helping adults to learn:**

**TOPIC 2: ORIGIN AND IMPORTANCE OF  
SWEETPOTATO**

**IN**

**EVERYTHING YOU EVER WANTED TO KNOW ABOUT  
SWEETPOTATO**

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## Topic 2: Origin and Importance of Sweetpotato

### 2.1 Where does sweetpotato come from?

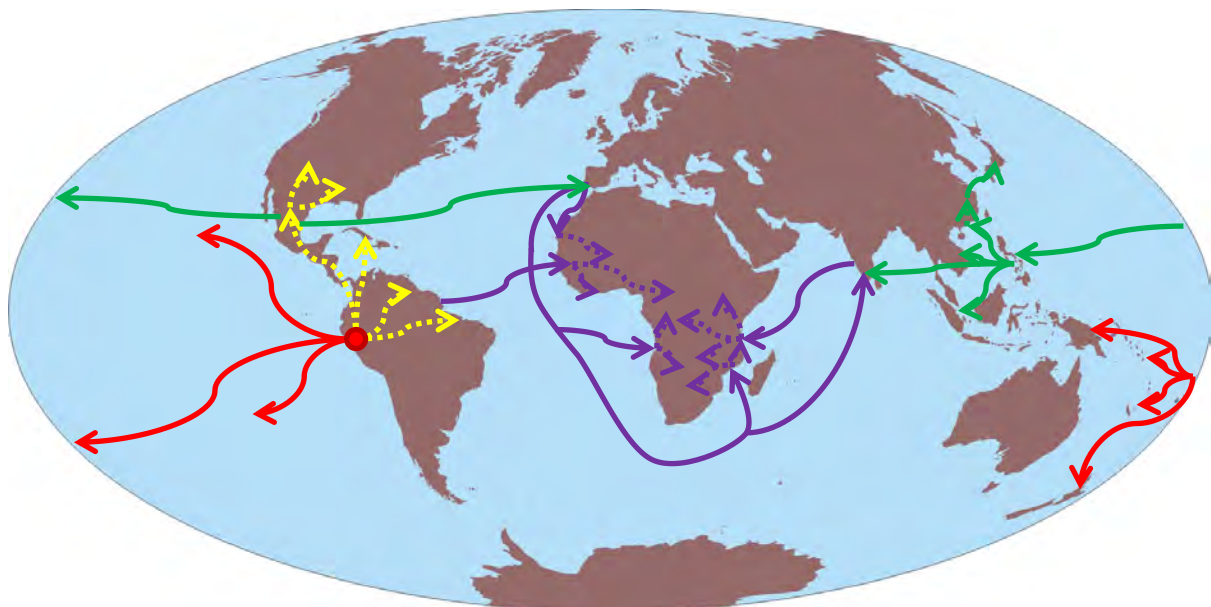
Since agriculture began farmers have selected, used, exchanged and transported planting materials over short and long distances, and natural selection has also worked on these plants. As a result it is difficult to assemble information on the origin and evolution of agricultural crops. Oral and written histories and molecular markers are used to try and trace the origins of different crops.

Sweetpotato (*Ipomoea batatas* (L.) Lam.) did not originate in Africa, it was domesticated at least 5,000 years ago in tropical America. Central America is believed to be the centre of origin of sweetpotato, with it being brought to Africa by Portuguese traders in the 16<sup>th</sup> Century. It was probably introduced on both the east and west coasts of Africa (possibly Angola and Mozambique), and then spread inland. Further introductions from India to East Africa occurred later under British colonial influences. Sweetpotato was already widely grown from Zanzibar to Egypt and used as food and for making beer by the time of the Speke-Grant expedition in the 1860's. The historical spread of sweetpotato from Latin America across the globe is shown in Table 2.1 and Figure 2.1.

**Table 2.1 Chronological spread of sweetpotato across the world**

8000 BC	<ul style="list-style-type: none"> <li>Sweetpotato present in Peru</li> </ul>
1000 BC	<ul style="list-style-type: none"> <li>Sweetpotato started to be cultivated in Peru during the last century BC</li> <li>It spread and became a staple food all over tropical America, as far as Northern Mexico and on the Caribbean islands</li> </ul>
13 <sup>th</sup> Century AD	<ul style="list-style-type: none"> <li>Via Peruvian or Polynesian voyages, sweetpotato was taken west to Easter Island and Hawaii</li> </ul>
14 <sup>th</sup> Century AD	<ul style="list-style-type: none"> <li>Sweetpotato was transported to the Pacific Islands and New Zealand</li> </ul>
early 16 <sup>th</sup> Century AD	<ul style="list-style-type: none"> <li>Spanish explorers took sweetpotato from Mexico to the Philippines, and to southern Spain</li> <li>From the Philippines it was taken to the East Indies and India</li> </ul>
late 16 <sup>th</sup> Century AD	<ul style="list-style-type: none"> <li>Due to famine in China, sweetpotato was imported as a food security crop, and then spread from the south across the east of the country</li> <li>Portuguese traders and slave traders took sweetpotato to Africa and India</li> </ul>
18 <sup>th</sup> Century AD	<ul style="list-style-type: none"> <li>Sweetpotato spread from China to Japan</li> </ul>

**Figure 2.1 Spread of sweetpotato cultivation from Peru to the Pacific islands →, overland across tropical America --→, to the Philippines and Spain →, and on to Africa and India →**



## 2.2 Where is sweetpotato produced and how is it used?

Sweetpotato is known scientifically as *Ipomoea batatas*. This important tropical root crop is the starchy root of a vine of the Convolvulaceae family. The morning glory and bindweed plants are also in this family. The round or Irish potato, *Solanum tuberosum* belongs to the Solanaceae family which is not related to the sweetpotato, and nor is the true yam (*Dioscorea* sp.) which belongs to the Dioscoreaceae family.

### Sweetpotato classification details:

Family: Convolvulaceae  
Genus: *Ipomoea*  
Section: Batatas  
Species: *Ipomoea batatas* (L.) Lam.

Globally there are over 600 species in the genus *Ipomoea*, and 13 of these are in the section Batatas. All these 13 species are native to the Americas, with sweetpotato being the only one which is cultivated and the only one which is hexaploid (6x =90). These wild relatives do not naturally cross pollinate with sweetpotato due to the differences in their ploidy (chromosome) level and complex compatibility and sterility systems. Although using biotechnology, researchers are experimenting with the use of wild relatives to try and improve different aspects of sweetpotato. In this manual we use the term sweetpotato variety to denote a group of sweetpotato plants which are genetically distinct and therefore differ in certain characteristics from other groups of sweetpotato plants within the species. When a variety is selected and cultivated it can be called a cultivar.



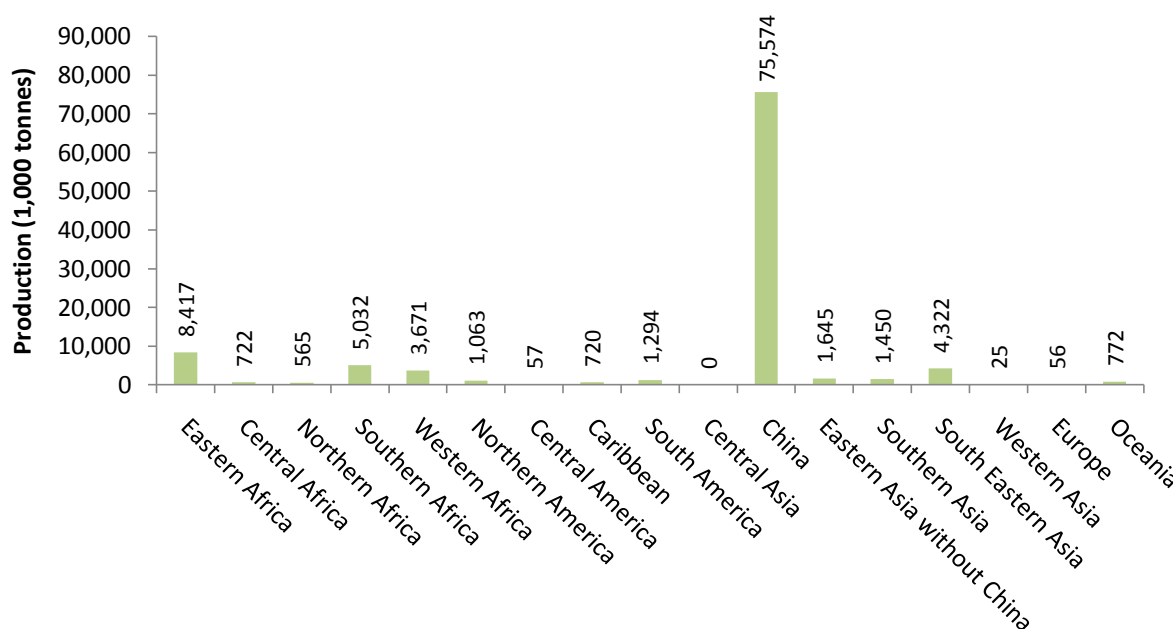
There are numerous varieties of sweetpotato. Most of the roots have an elongated slightly pointed shape to them, and come in a range of sizes, forms and colours. Depending on the variety the outside skin may be white, yellow, red, purple or brown, and the flesh white, yellow, orange or purple. There are a wide range of tastes and textures amongst the different sweetpotato varieties.

There is often confusion as to whether sweetpotato is a root crop or a tuber crop. It is a root crop. In tuber crops, the tuber is in fact a modified stem (stolon or runner), which thickens to become a specialised swollen stem for use as a storage organ. The tuber will thus have all the normal parts of a stem, including nodes and internodes. A round/ Irish potato is a tuber crop; the eyes on its tubers are in fact nodes, each of which have a leaf scar. Internally, the tuber has the typical cell structures of a stem, with pith, vascular zones and cortex. By contrast the enlarged sweetpotato roots (also used as storage organs) have the internal and external cell structures of typical roots, with no nodes, internodes or buds.

Sweetpotato is the seventh most important food crop in the world after wheat, rice, maize, potato, barley and cassava. In 2011, about 8 million hectares of the world's agricultural land were used to grow sweetpotato, and over 95% of the world's sweetpotato output was from developing countries. An overview of sweetpotato production by geographical area is shown in Figure 2.2.1. The data for China has been separated to highlight the comparatively huge scale of sweetpotato production in the country. In Africa, sweetpotato is particularly important in countries surrounding the Great Lakes in East and Central Africa; Malawi, Angola, Mozambique, and Madagascar in Southern Africa, and Nigeria in West Africa (see Figure 2.2.2).

A comparison of the quantities of the main root and tuber crops grown in various African countries is given in Figure 2.2.3. In Nigeria and Ghana where huge quantities of cassava and yam are produced, sweetpotato is the fourth most important root and tuber crop, after cassava, yam and taro. While in Tanzania, Uganda, Mozambique and Malawi sweetpotato is the second most important root crop after cassava. In Rwanda it comes third after cassava and round/Irish potato. In Burkina Faso more sweetpotato is produced than cassava, but production levels of both are low compared to the other countries.

**Figure 2.2.1 Overview of sweetpotato production across the world in 2009-2011**



Source: FAOSTAT and Eastern Africa includes Malawi National Programme and Ministry of Agriculture data

Eastern Africa includes Burundi, Comoros, Ethiopia, Kenya, Mauritius, Réunion, Rwanda, Somalia, Uganda, Tanzania.

Central Africa includes Cameroon, Chad, Congo, Democratic Republic of the Congo, Equatorial Guinea, Gabon.

Northern Africa includes Egypt, Morocco, Sudan (former).

Southern Africa includes South Africa, Swaziland, Madagascar, Malawi, Mozambique, Zambia, Zimbabwe, Angola.

Western Africa includes Benin, Burkina Faso, Cape Verde, Côte d'Ivoire, Ghana, Guinea, Liberia, Mali, Mauritania, Niger, Nigeria, Senegal, Sierra Leone, Togo.

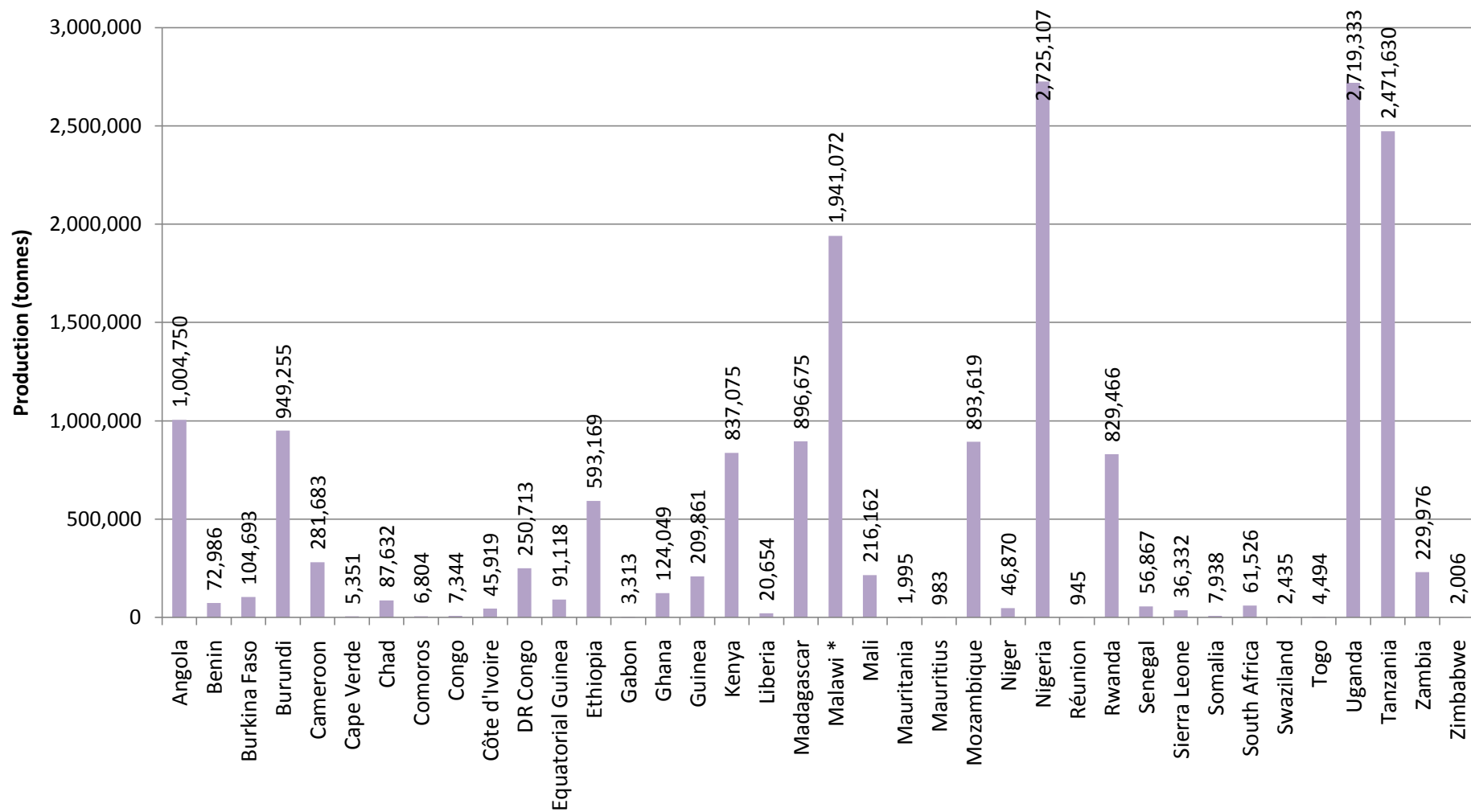
Given the wide cultivation and trade of sweetpotato around the world, it is no surprise to find it used in many different ways as food, animal feed and industrial products.

The fresh roots can be boiled or roasted, and then may be further processed by mashing into puree to use in a range of products including breads, chapatis, cakes, juices, porridge etc. The fresh roots can also be cut into chipped or small pieces and sun-dried and kept as an important food stock to rehydrate and eat during the year or made into flour, breakfast cereals or noodles. In some African countries such as Uganda, Rwanda and Burundi starchy crops are the staple food and 75 - 150 kgs of sweetpotato are consumed per person per year. In countries with maize-based food systems, such as Kenya, Angola, Mozambique and DR Congo sweetpotato is an additional food and only 5 – 50 kgs of it are consumed per person per year.

In some countries sweetpotato roots are processed to produce starch, noodles, candy, pink to black cloth dyes and fermented to make alcohol. In China, sweetpotato starch production has become an important cottage industry.

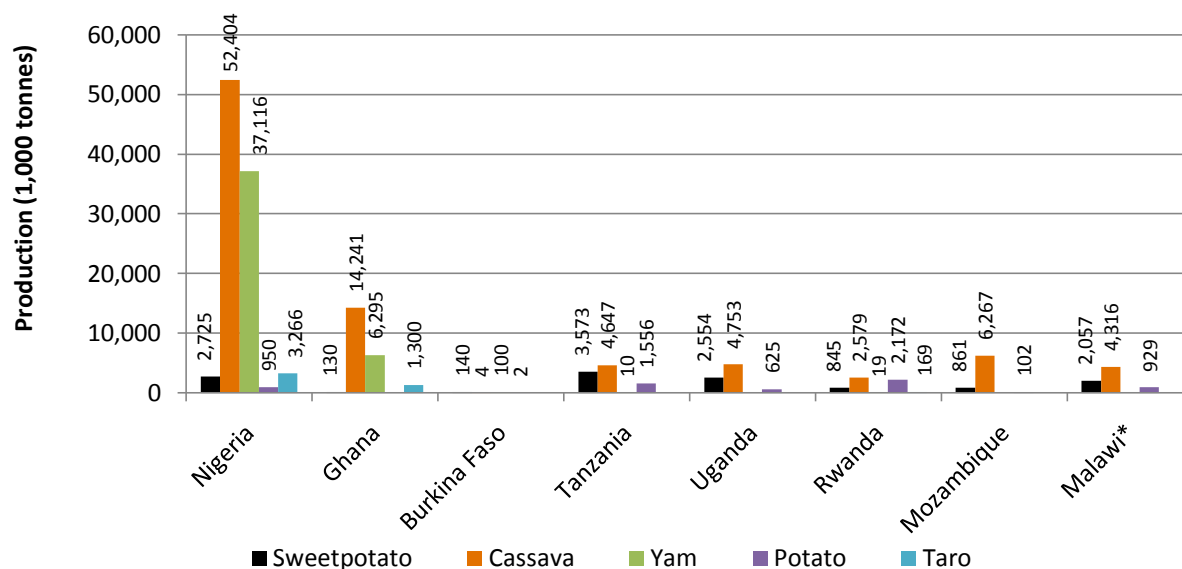
In the US, scientists have developed genetically modified sweetpotato plants containing edible vaccines against hepatitis B and the Norwalk virus. Novel edible vaccines such as these may in future provide cheap forms of health protection.

Figure 2.2.2 Overview of annual sweetpotato production across Sub-Saharan Africa from 2009-2011



Source: FAO STAT and \*Malawi National Programme and Ministry of Agriculture data

**Figure 2.2.3 Annual root and tuber crop production in selected African countries in 2011**



Source: FAOSTAT and \*Malawi National Programme and Ministry of Agriculture

Sweetpotato leaves are nutritious and widely eaten as a vegetable dish in many parts of the world.

Sweetpotato is also used as an animal feed in many places, the vines can be fed fresh or made into silage. Raw sweetpotato roots contain an anti-nutritional factor (trypsin inhibitor), which prevents the starch from being easily digested, cooking or chopping and drying can deactivate this factor. In China, 70% of the huge quantities of sweetpotato grown go to animal feed, mainly for pig production. In Asia, the sweetpotato – pig production system is a common and important feature of rural livelihoods. In Africa, sweetpotato is often referred to as the ‘poor person’s crop’ and typically grown on a small scale as a subsistence crop by women, its use as animal feed is usually limited to the vines. However, things are changing as the area of sweetpotato grown and its degree of commercialisation in Africa increases.

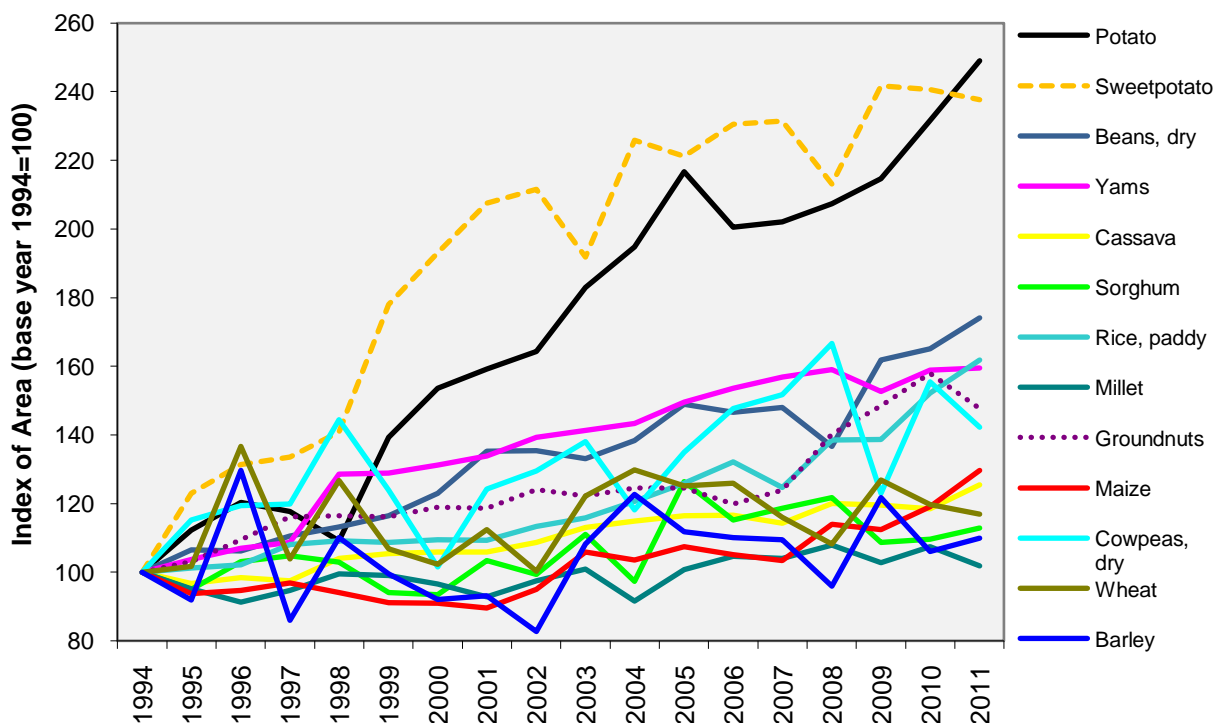
Sweetpotato produces more biomass and nutrients per hectare than any other food crop in the world. It is typically grown without fertilisers or irrigation, can grow from sea level to altitudes of up to 2,500 metres, from temperatures of 15 to 33°C, has flexible planting and harvesting times, needs little care and matures quickly; and has throughout history and across the world played an important role in saving people from famine.

Sweetpotato root yields differ greatly across the world, with Asia averaging 18.5 tons/ha, the USA 16.3 tons/ha, South America 12.2 tons/ha and Africa 4.7 tons/ha. Under excellent management and input use yields of 40-50 tons/hectare are obtained in South Africa. These yield differences reflect many issues including the use of poor quality and virus infected planting materials, the relative status of sweetpotato and other crop management aspects (e.g. planting techniques; spacing; soil fertility, water, pest and disease management). This training course aims to help remove some of these barriers to enable sweetpotato production to increase across Sub-Saharan Africa.

## 2.3 What trends are affecting sweetpotato production and use?

Increasingly Sub-Saharan African farmers are responding to the decline in cultivable land size due to increasing population by growing more root and tuber crops (Fig. 2.3.1), which give higher yields per unit area than grain crops do. Sweetpotato is considered a low labour, low cost and low risk crop which helps families struggling with illness, increasing care requirements and resource losses due to the impacts of HIV/AIDS.

**Figure 2.3.1 Growth in cultivated crop area of the main African field crops from 1994 to 2011**



Source: FAOSTAT and Malawi Ministry of Agriculture

As agriculture becomes more market-oriented in Sub-Saharan Africa, sweetpotato is one of several crops that farmers can produce to obtain cash income in addition to subsistence food security. Markets for fresh roots and vines do exist, but with a few exceptions (e.g. Uganda) are not large. However, Africa is rapidly urbanising. Projections show that by 2030 there will be over 759 million African urban dwellers. This urbanisation and the associated food system changes are likely to lead to an increase in demand for fresh roots and value-added sweetpotato-based products; further work on understanding these trends in different countries in the region is required.

Sweetpotato roots are a healthy food: all varieties have high levels of vitamins C and E, several B vitamins, iron, zinc, potassium, and fibre. The orange-fleshed varieties are very high in pro-vitamin A or beta-carotene, which when eaten is converted into vitamin A (retinol) in the intestines and liver. In addition they have anti-carcinogenic and cardiovascular disease-preventing properties, and can be used in products for consumers who are allergic to grain breads and flours. Processed sweetpotato products are projected to increase in the developed world.

In eastern and southern Africa some 3 million children under the age of 5 suffer from dry eye or *Xerophthalmia*, which causes blindness. Due to lack of vitamin A in the diet, many of the affected children die within a few months of becoming blind. In Sub-Saharan Africa, 43 million children under the age of 5 are vitamin A deficient. If incorporated into the diet, the orange fleshed sweetpotato (OFSP) varieties high in beta-carotene can eliminate vitamin A deficiency in children and adults.

## 2.4 Why promote sweetpotato?

Sweetpotato is one of the most widely grown root crops in Sub-Saharan Africa, covering around 3.2 million hectares with an estimated production of 13.4 million tons of roots in 2005. It is a crop that is predominantly grown by resource poor smallholder farmers, particularly women. There are real opportunities to boost the productivity and utilisation of sweetpotato, and investing in this will directly benefit the poor through improving their incomes and nutritional status. The overlap between the areas where sweetpotato is already cultivated and areas of human malnutrition (Figures 2.4.1 and 2.4.2) highlights the important opportunities that boosting the production and utilisation of more nutritional sweetpotato varieties would achieve.

Trends suggest sweetpotato production and utilisation will continue to increase in Sub-Saharan Africa and elsewhere. Given the relatively easy production methods, high nutritional value and pro-poor nature of the sweetpotato crop, enhancing its production and utilisation in Sub-Saharan Africa can be seen as a major opportunity for poverty reduction, income generation, food and nutrition security and sustainable ecosystems.

Gender issues are important in sweetpotato improvement efforts in Africa because: a) production resource constraints faced by women producers coupled with their limited access to technologies, education and financial services and lack of decision-making powers contribute to the current low sweetpotato yields; and b) women are the key nutrition decision-makers in most societies, and therefore efforts to promote orange-fleshed sweetpotato for improved child and maternal nutrition must focus on them.

Investing in sweetpotato has great potential for improving women's income and household nutrition and health but as the crop becomes increasingly commercialized, strategies to ensure gender equitable commercialization interventions need to be designed. The gender and diversity issues important for promoting sweetpotato are explored in detail in Topic 11.

CIP's strategy for enhancing sweetpotato production and utilisation is described in the adjacent box. Within Sub-Saharan Africa, CIP focuses its sweetpotato work on the 17 countries which together produce 95% of the sweetpotato grown. These countries and their sweetpotato production quantities, areas and yields are shown in Table 2.4.1.

However, enhancing the production and utilisation of sweetpotato in Sub-Saharan Africa is not without challenges (see section 2.5).

### **Towards poverty reduction, food and nutrition security and sustainable ecosystems through enhancing sweetpotato production**

- To collect, conserve and characterize sweetpotato germplasm
- To add value to that germplasm through genetic enhancement and crop improvement
- To improve productivity through crop protection, crop management and better seed
- To reduce vulnerability in a changing world through sustainable intensification of sweetpotato systems
- To strengthen the positive and reduce the negative impacts of food and farming on human health
- To identify and target priorities and provide policy relevant research to support sweetpotato sector development

*CIP's strategy*

Figure 2.4.1 Map of Africa showing density of sweetpotato cultivation

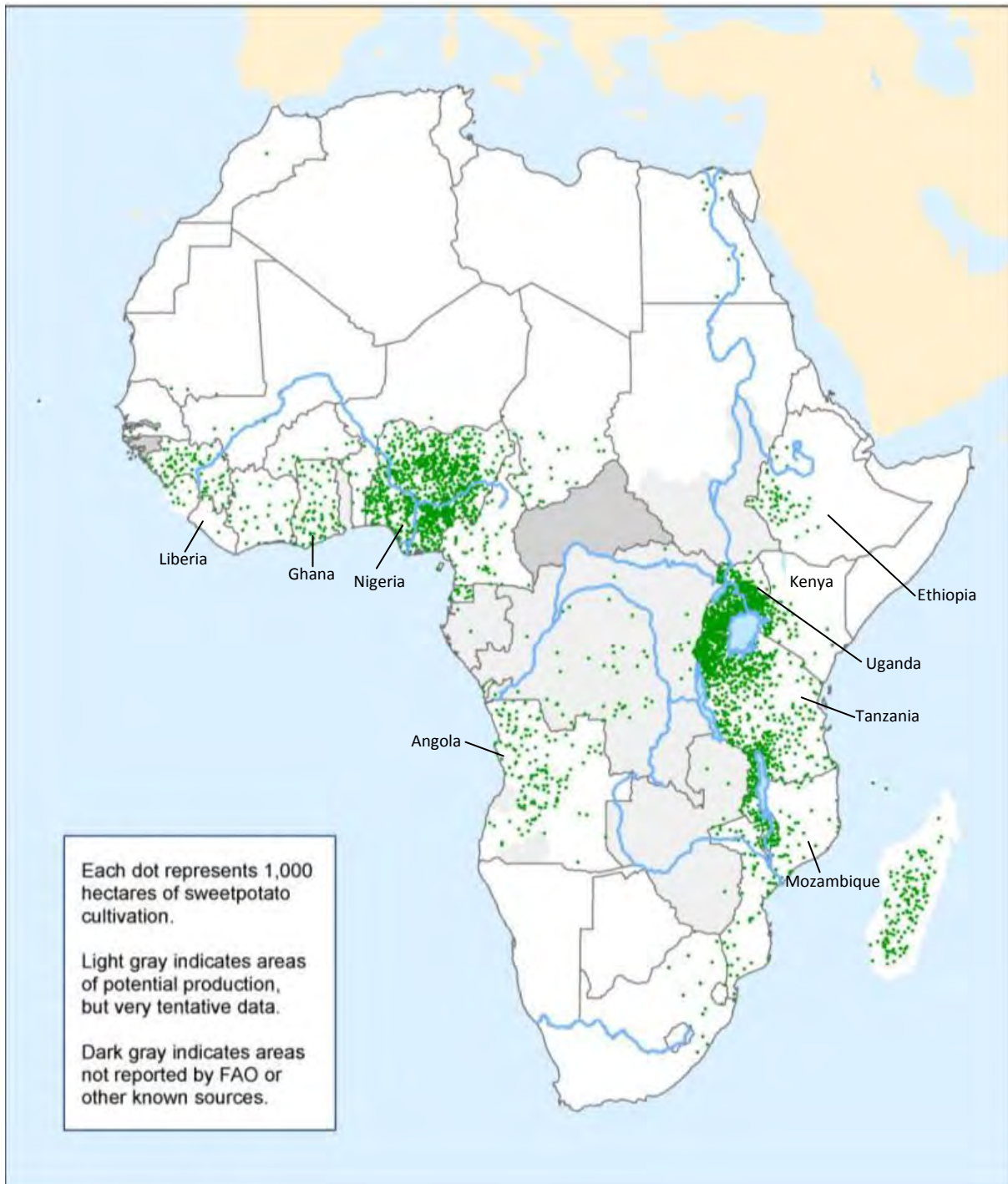
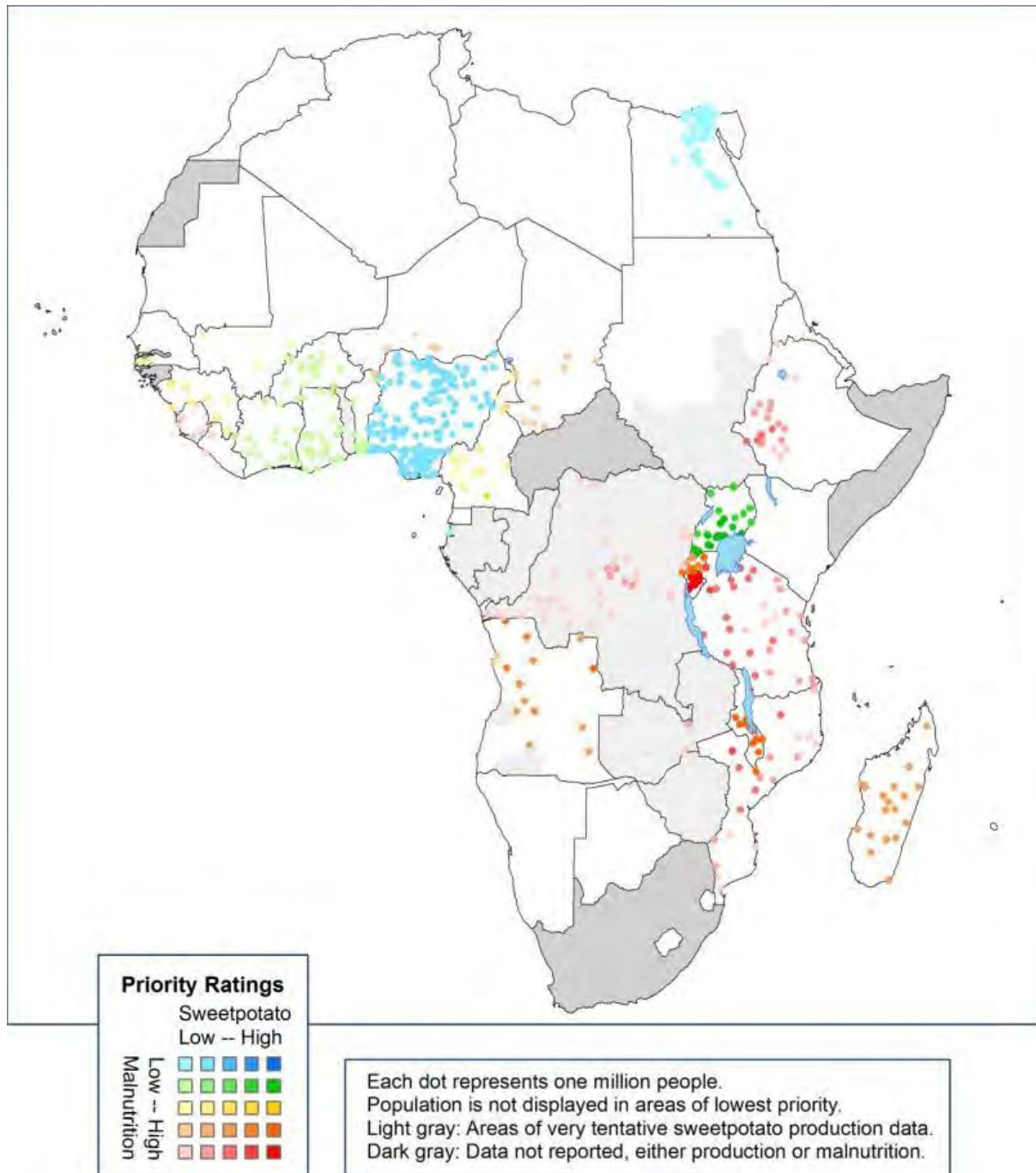




Figure 2.4.2 Map of Africa showing incidence of malnutrition and sweetpotato production



**Table 2.4.1 Sweetpotato production and area cultivated, population density and estimated yields for the 17 major producing countries in Sub-Saharan African (SSA)**

Sub-region	Country	Average 2009-2011					
		Sweetpotato Production ('000 Metric tons)	% of the total Sweetpotato Grown in SSA	Sweetpotato Production per Capita (kgs/person)	Population density in 2011 (persons/ sq km)	Area (1,000 has)	Estimated Yield (Tons/ha)
	Uganda	2,719	14.4	78.8	173	587	4.6
	Tanzania	2,472	13.1	53.5	52	642	3.8
	Rwanda	829	4.4	75.8	444	114	7.3
	Burundi	949	5.0	110.7	334	138	6.9
	Kenya	837	4.4	20.1	73	74	11.3
	Ethiopia	593	3.1	7.0	85	67	8.8
	DR Congo	251	1.3	3.7	30	49	5.1
<i>East &amp; Central Africa</i>		<b>8,651</b>	<b>45.9</b>			<b>1,671</b>	<b>5.2</b>
	Malawi	1,941	10.3	126.2	163	178	10.9
	Madagascar	897	4.8	42.1	37	122	7.3
	Angola	1,005	5.3	51.2	16	155	6.5
	Mozambique	894	4.7	37.3	30	123	7.3
	Zambia	230	1.2	17.1	18	14	16.9
	South Africa	62	0.3	1.2	42	19	3.2
<i>Southern Africa</i>		<b>5,028</b>	<b>26.7</b>			<b>610</b>	<b>8.2</b>
	Nigeria	2,725	14.5	16.8	178	943	2.9
	Ghana	124	0.7	5.0	110	74	1.7
	Burkina Faso	105	0.6	6.2	62	8	13.8
	Benin	73	0.4	8.0	82	16	4.5
<i>West Africa</i>		<b>3,027</b>	<b>16.1</b>			<b>1,041</b>	<b>2.9</b>
<b>All 17 countries</b>		<b>16,705</b>	<b>89</b>			<b>3,323</b>	<b>5.0</b>

Source: Updated version of table in Low, 2008 using FAOSTAT and Malawi National programme and Min of Ag.

## 2.5 What are the challenges to sweetpotato production and utilisation?

The major challenges to sweetpotato production and utilisation in Sub-Saharan Africa are:

### 1. Lack of access to virus- and pest-free "clean" planting material.

Many sweetpotato plants in Sub-Saharan Africa are infested with virus diseases. Use of clean healthy planting materials could bring instant yield gains of 30-60%. However, maintenance of planting materials during the prolonged dry season is a challenge, and results in delayed planting while sufficient planting materials are replicated. New vine conservation techniques, more drought tolerant varieties, small-scale dry season irrigation, and use of the triple S root sprouting method can help provide significant quantities of planting materials at the beginning of the rains. Insect pests are attracted to vine multiplication plots during the dry season, and therefore appropriate pest management strategies are needed to ensure pest- and virus-free planting materials can be locally supplied.

### 2. Lack of improved varieties adapted to local environments that meet consumer preferences.

Improved sweetpotato varieties are projected to offer yield gains of ~20% compared to healthy local landraces. In addition to yield, quality traits such as higher micronutrient content, dry matter content, sugar content, and taste which can improve the market demand and nutritional value of sweetpotato can also be selected for through breeding.

### *3. Damage due to sweetpotato weevils, particularly in drier production zones.*

Sweetpotato weevils are the most important pests of sweetpotato in Africa and worldwide, and production losses may often reach 60% to 100%. Effective management of this pest could also extend the in-ground storage period in drier areas, reducing seasonality and improving food security. Whilst IPM strategies exist, these could be enhanced through further research and dissemination.

### *4. Insufficient knowledge and poor agronomic practices.*

Adoption of better agronomic practices (site selection, planting techniques, spacing, weed control, and soil fertility management) could substantially increase yields by as much as 60%.

### *5. Poor development of products and potential markets.*

Research in Mozambique and Kenya has demonstrated that farmers will substantially invest in labour and/or purchase input-demanding technologies *only* when there is a market to absorb surplus root production. Bulky products like sweetpotato roots are relatively expensive to transport, and good post-harvest care is essential to assure reasonable shelf-life. In many parts of Asia sweetpotato roots are used as animal feed and processed into starch and other processed products. In Sub-Saharan Africa, the value-added use of sweetpotato is still in its infancy and further work is needed to improve product quality and market chain efficiencies. Promotion of its nutritional benefits, especially of orange-fleshed sweetpotato (OFSP) varieties is needed to increase awareness and stimulate demand.

An overview of the agronomic characteristics and constraints of sweetpotato compared to the other root and tuber crops, cassava, potato and yam is shown in Table 2.4.2.

## **2.6 Advocating for orange-fleshed sweetpotato**

Orange-fleshed sweetpotato (OFSP) is still relatively new in most parts of Sub-Saharan Africa and therefore advocacy is needed to help people understand what it is and how it can be useful as a sustainable and low cost biofortification tool in the fight to reduce vitamin A deficiency across the region.

Advocacy is defined as efforts based on the strategic use of information to influence decision-makers and the wider public about specific issues or problems. Advocacy is not the same as promotion which is about raising awareness in a general sense. A key focus for OFSP advocacy should be increasing investments in OFSP by relevant stakeholders (government at all levels, NGOs, private sector, donors) and policy reform to achieve widespread dissemination and utilization of orange-fleshed sweetpotato and the integration of biofortification as part of a holistic approach to addressing vitamin A deficiency.

Anyone can be an OFSP advocate including individuals, organizations and the media. There is a large literature on 'how to do advocacy' (see for example [www.unicef.org/evaluation/files/Advocacy\\_Toolkit.pdf](http://www.unicef.org/evaluation/files/Advocacy_Toolkit.pdf)). The Reaching Agents of Change (RAC) Project has developed an OFSP advocacy toolkit consisting of factsheets, flyers, videos and powerpoint presentations (see <http://sweetpotatoknowledge.org/sweetpotato-introduction/ofsp-advocacy-toolkit>). For full details of how to register use the sweetpotato knowledge portal online resource see Appendix 2.

**Table 2.4.2 Main agronomic characteristics and constraints faced by sweetpotato, potato, cassava, and yam**

Characteristics	Sweetpotato	Cassava	Potato	Yam
Growth Period (months)	3-8	9-24	3-7	8-11
Annual or Perennial Plant	Perennial	Perennial	Annual	Annual
Optimal rainfall (mm)	750-1000	1000-1500	500-750	1150
Optimal temperature (°C)	>24	25-29	15-18	30
Drought resistant	Yes	Yes	No	Yes
Optimal pH	5.6-6.6	5-6	5.5-6.0	N/A
Fertility requirement	Low	Low	High	High
Organic matter requirement	Low	Low	High	High
Planting material	Vine cuttings, Sprouting roots	Stem cuttings	Whole tubers, Cuttings	Tubers
Storage time in ground	Long	Long	Short	Long
Post harvest storage life (fresh)	Short to Medium	Short	Long	Long
Post harvest storage life (dried)	4-6 months	> 6 months	Not usually practiced	>8 months
<b>Technical Constraints</b>	<ul style="list-style-type: none"> <li>Bulkiness/perishability</li> <li>Low multiplication rates</li> <li>Phytosanitary restrictions</li> <li>Low dry matter, yields</li> <li>Viruses</li> <li>Weevils</li> </ul>	<ul style="list-style-type: none"> <li>Lengthy growing season</li> <li>Low multiplication rate</li> <li>Bulky planting material</li> <li>In SSA: poor soils, lack of planting material, cassava mosaic virus; brown streak virus, bacterial blight, mealybug</li> </ul>	<ul style="list-style-type: none"> <li>Costs/difficulties of maintaining seed quality</li> <li>Low multiplication rates</li> <li>Bulky seed</li> <li>Perishability</li> <li>Late blight</li> <li>Bacterial Wilt</li> <li>Seed systems</li> <li>Insects, e.g. aphids vectors of virus</li> </ul>	<ul style="list-style-type: none"> <li>Bulky planting materials</li> <li>Low multiplication rates</li> <li>Long dormancy (with respect to cropping cycles)</li> <li>Phytosanitary restrictions</li> <li>Declining soil fertility</li> <li>Staggered emergence</li> <li>Interplay of virus, nematodes, fungi, and insect pests</li> </ul>
<b>Socio-economic constraints</b>	<ul style="list-style-type: none"> <li>Low status/stigma</li> <li>High cost of raw material when used for processing</li> <li>Small-resource poor farmers</li> <li>Weak supply chain linkages</li> </ul>	<ul style="list-style-type: none"> <li>Lack of producer organizations</li> <li>Small farmers, marginal and dispersed growing areas</li> <li>Limited traditional markets; risks for new markets</li> <li>Underdeveloped internal markets</li> </ul>	<ul style="list-style-type: none"> <li>Production cost/lack of credit</li> <li>Price volatility</li> <li>Market access</li> </ul>	<ul style="list-style-type: none"> <li>Costly planting materials</li> <li>Lack of processing technologies</li> <li>High labour costs for production</li> <li>Limited options for pest control</li> <li>Underdeveloped international markets</li> </ul>
<b>Policy and Institutional Constraints</b>	<ul style="list-style-type: none"> <li>Odd crop out</li> <li>Policy neglect</li> <li>No industry forum</li> <li>Weak NARIs</li> </ul>	<ul style="list-style-type: none"> <li>Limited resources for cassava R&amp; D</li> <li>No cassava "lobby" for policy</li> <li>Limited access to credit</li> </ul>	<ul style="list-style-type: none"> <li>Limited sector development</li> <li>Weak technology transfer</li> </ul>	<ul style="list-style-type: none"> <li>Policy neglect</li> <li>Limited research</li> <li>Limited human and other resources for research and development</li> <li>Gender bias</li> </ul>

Source: Adapted from Scott *et al.*, 2000.

## 2.7 Debunking the myths around sweetpotato: what are the facts?

Many inaccurate beliefs around sweetpotato affect demand for it. A few common sweetpotato myths and the relevant facts are shown below.

**Myth 1:** Eating sweetpotato or foods containing sweetpotato, causes diabetes

**Fact 1:** Type 2 diabetes (a condition where the body does not produce enough insulin or insulin is not working properly, with resultant high blood sugar), the most common type of diabetes, is not caused by eating sweet foods. However, a poor diet especially one full of certain types of sugar, increases the probability of getting the disease. Risk factors for developing type 2 diabetes include hypertension, high blood triglyceride (fat) levels, a high-fat diet, high alcohol intake, a sedentary lifestyle (little exercise), and being overweight or obese.

Contrary to this myth, sweetpotato is often a recommended food for diabetics since it has a lower glycemic index (GI) than many other starchy foods. This is due in part to its high fibre content. Low GI foods release glucose slowly into the bloodstream which helps to control blood sugar (glucose) level. Many diets promote sweetpotato as a fat-burning food and it is at the top of many Best Foods to Eat lists.

**Myth 2:** Sweet foods and sweetpotato are good for women and children but cause infertility and sterility in men

**Fact 2:** Sweet tasting foods do NOT have a negative effect on male fertility. In fact, vitamin A found in OFSP and other foods is important for preventing sluggish sperm; OFSP is also high in folic acid – a B vitamin with antioxidant properties that is crucial for keeping sperm free of chromosomal abnormalities. Adequate folate intake (folate is the form of folic acid that naturally occurs in the body) is also important for women before and during pregnancy. OFSP, packed with vitamins A, C, E and folate, is the perfect fertility food for men and a healthy food that can be enjoyed by the whole family.

**Myth 3:** Sweetpotato leaves are not good for human consumption

**Fact 3:** Sweetpotato leaves are eaten in many parts of Africa. They are rich in nutrients and functional compounds including complex carbohydrates, protein, amino acids, soluble and insoluble dietary fibre, omega-3 fatty acids, vitamins and minerals (vitamin A, folate, vitamin C, calcium, magnesium, phosphorous), antioxidants, and other bioactive compounds. Young leaves (less than three months) are tender and preferred to mature leaves. To get the maximum benefit, do not overcook leaves.

**Myth 4:** OFSP can improve your eyesight and reverse blindness

**Fact 4:** Children and pregnant women who do not have enough vitamin A in their diet may suffer from night blindness (difficulty or inability to see in dim light). In children, this can progress to conditions that damage the eye such as Bitot spots (foamy white patches on the white part of the eye) and Xerophthalmia (dryness of the cornea and conjunctiva) which can eventually lead to irreversible blindness.

Vitamin A in OFSP and other foods promotes good vision and helps prevent problems but cannot reverse blindness once it has occurred.

**Myth 5:** OFSP is a genetically modified crop (GMO)

**Fact 5:** Sweetpotato is a genetically rich and diverse crop, and all its different flesh colours (white, cream, yellow, orange, and purple) are found in nature. Some varieties produce roots and vines, and others produce only vines and leaves. Over 5,000 different sweetpotato varieties are kept in the gene bank of the International Potato Centre to preserve its biodiversity and serve the world's breeding programmes. OFSP has not been genetically modified to increase its pro-vitamin A content.

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Notes on: ***Origin and Importance of Sweetpotato***

# **TOPIC 3: SWEETPOTATO VARIETAL SELECTION AND CHARACTERISTICS**

## **IN**

# **EVERYTHING YOU EVER WANTED TO KNOW ABOUT SWEETPOTATO**

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## Topic 3: Sweetpotato Varietal Selection and Characteristics

### 3.1 Natural diversity of sweetpotato

Sweetpotato might have originated in Central America more than 10,000 years ago, but since then it has spread across continents with varieties developing and being selected for different agro-ecological conditions and uses. There are now said to be thousands of sweetpotato varieties available in the world, with CIP holding over 6,000 landraces, breeding lines and advanced cultivars in its gene bank.

Sweetpotato varieties differ from each other in many ways, including leaf shape and colour, vine structure, root shape, root skin colour, flesh colour, taste, texture, dry matter content, resistance to pests and diseases and yield.

The range of flesh colours from white, through yellow, to deep orange and even dark purple is astounding. This wide and striking range of flesh colours leads to some people erroneously suggesting the different colours are the result of genetic engineering. However, they are not, they are simply the natural flesh colours. Whilst there is some research work looking into the genetic engineering of traits such as: virus resistance; insect resistance; starch modification; baking properties; drought, heat and salt tolerance; protein quality; and herbicide resistance in sweetpotato, no genetically engineered sweetpotato varieties are being promoted through the *Reaching Agents of Change* (RAC) project. All the varieties being promoted through the RAC project have been bred using conventional breeding practices.

The sweetpotato flesh in addition to its wide range of colours also has a wide range of tastes from sweet to bland, and textures and dry matter content.

These different characteristics play a role in the decision-making of farmers, traders and processors regarding which varieties to use, and it is important for development workers to be aware of consumer and market preferences. For example, the adult African palate prefers a dry and floury sweetpotato.

Despite the existence of such diversity, in any specific geographical area there tend to be just a few dominant varieties that are planted by farmers. There are usually fewer varieties in areas with a strong market orientation than where the crop is grown predominantly for local consumption. The predominant varieties are typically selected based on market demand and the planned use of the sweetpotato. In eastern and southern Africa an early maturing variety (matures 3 months after planting) with high dry matter content (30-33%), cream skin and yellow flesh emerged as a market favourite. It is known as SPN/O, Simama, Tanzania, Kenya or Chingova depending on the country. However, researchers and farmers are constantly developing and evaluating new varieties, and the predominant varieties do change over time. The above SPN/O variety is no longer the predominant variety in many places, having been replaced by better performing market-preferred varieties.

In Uganda two orange-fleshed sweetpotato (OFSP) cultivars were released a few years ago (Ejumula, and SPK004 which is also known as Kakamega). Both varieties have high dry matter content (>30%) and a dry texture when cooked. Within the communities where they were promoted, they went from constituting 3.2% of the total sweetpotato production in 2004, to 22.4% of



total production in 2006. With the frequency of farmers producing OFSP increasing from 21.7% to 64.3% during this same two year period, highlighting the very fast acceptance of these two new varieties. More recently released OFSP varieties, such as: the 15 in Mozambique (Tio Joe, Namanga, Bela, Lourdes, Ininda, Irene, Cecilia, Erica, Delvia, Melinda, Amelia, Sumaia, Esther, Jane, Gloria); Mataya and Kiegea in Tanzania; Zondeni in Malawi; NASPOT 8, Vita and Kabode in Uganda; Bokye and Apomuden in Ghana; King J and Mother's Delight in Nigeria; and RW11—266 and RW11-2910 in Rwanda will presumably find even greater acceptance.

### 3.2 What characteristics are you looking for in your sweetpotato plants?

Farmers are always on the lookout for new varieties with better characteristics such as:

- higher yield potential;
- good root characteristics (e.g. determined by shape, size, skin colour, flesh colour, dry matter content, and nutritional value);
- appreciable tolerance to major diseases and pests;
- drought tolerance;
- a dry taste;
- a higher market price;
- the ability to produce enough planting material;
- long in-ground storability; and
- a shorter period to harvest (early maturity, about 3 to 4 months after planting).

However, it should be remembered that each variety performs differently under different situations, depending on location-specific and seasonal conditions. This highlights the importance of varietal testing by and with farmers under different agro-ecological zones and farmer management, so that farmers can select those most likely to perform well in their specific locations. We describe how you can do this in section 3.3.

Male and female farmers often identify the same preferred characteristics (root yields and size) but there can be differences along gender lines, reflecting the gender roles in production and processing. Women farmers tend to be more interested in cooking qualities such as cooking time, low oil absorption during frying and the tendency of cooked roots to crumble compared with men. In situations where men are responsible for root sales, they are more likely than women to be interested in market related characteristics.

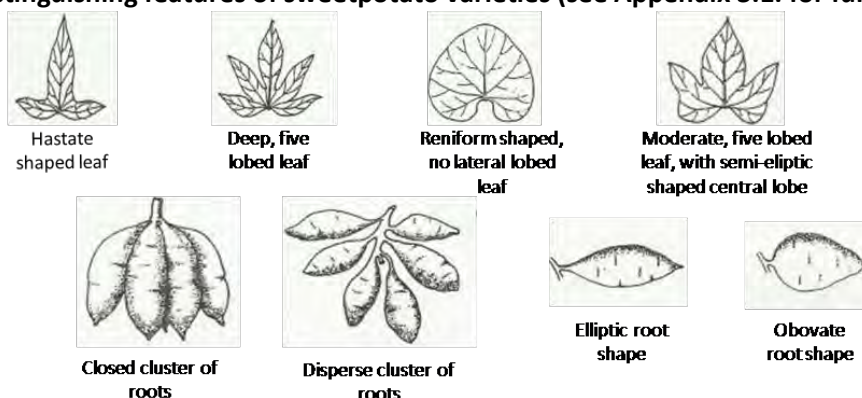
A farmer field school group in Uganda, identified the most desirable attributes as high yields (for increased income returns), sweet taste (for home and market acceptance), vitamin A content (to improve health problems in the community), early maturity (for food security), pest and disease resistance (to minimize losses) and drought tolerance (to help supply of planting materials at the start of the rains). The same group identified the most undesirable attributes as: low yields (low income returns, food insecurity, waste of farmers' energy and time), high fibre content and poor taste (low consumer acceptability and therefore difficult to sell), susceptibility to pests and diseases (low yields and wastage of resources), small root size (difficult to sell and to peel).

Just as we distinguish people by their features, sweetpotatoes have distinguishing features that help to tell them apart. The features that are most useful for sweetpotato variety identification are plant growth habit, vine colour, petiole colour, leaf shape, leaf colour, root shape, root skin colour, and root flesh colour. Examples of some features are shown in Figure 3.1 below. Full details of sweetpotato descriptors are given in Appendix 3.1. Beta-carotene content of orange-fleshed sweetpotato roots can be estimated from their colour (Figure 3.2), a field chart for estimating the beta-carotene content of orange-fleshed sweetpotato roots is

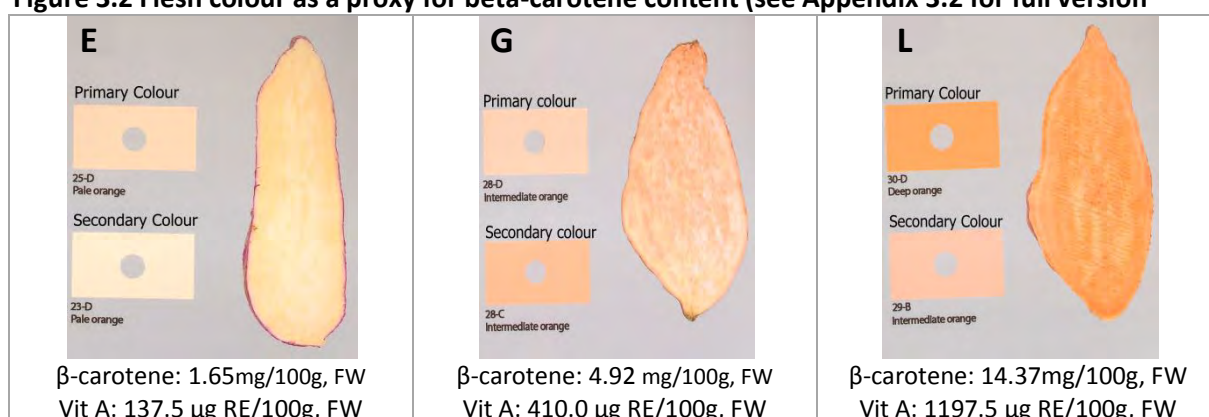


given in Appendix 3.2. A form for recording key morphological descriptors is presented in Appendix 3.3.

**Figure 3.1. Distinguishing features of sweetpotato varieties (see Appendix 3.1. for full version)**



**Figure 3.2 Flesh colour as a proxy for beta-carotene content (see Appendix 3.2 for full version)**



Promising orange-fleshed varieties for Sub-Saharan Africa are illustrated in a Sweetpotato Catalogue available and updated on the Sweetpotato Knowledge Portal [www.sweetpotatoknowledge.org](http://www.sweetpotatoknowledge.org) or from any CIP office. The catalogue shows details of the characteristics of the different varieties.

It is important to realise that the same varieties sometimes have different names in different locations, and sometimes different varieties are called by the same name. Indeed, different “strains” or “types” of the same variety can exist, which may be very difficult to distinguish from each other, so seed multipliers need to be really familiar with the varieties they are multiplying.

GROWTH CHARACTERISTICS	
Canopy or plant type	Spreading (> 100 cm vine length)
Leaf	Green when mature, 3-4 moderately deep lobes
Vine	Green, short (3-5 cm) vine internodes, intermediate (7-9 mm) vine diameter
Flowering ability and habits	Late and sparse
MAJOR AGRONOMIC ATTRIBUTES	
Maturity period	4 months
Root yields	14.7 t/ha
Adaptability	Does well in low virus pressure zones
Resistance to pests	Low to sweetpotato weevils
Resistance to diseases	High to Alternaria blight and low to sweetpotato virus disease
ROOT CHARACTERISTICS	
Shape	Long irregular
Skin colour	Cream
Dry matter	33.0%
Flesh colour (CIP colour chart)	Deep orange, (30D-29B)
$\beta$ -carotene content	7760 - 14370 $\mu$ g/100g fw b content
SENSORY CHARACTERISTICS	
Colour of boiled roots	Deep orange, appealing to adults and children
Texture of boiled roots	Dry and floury mouth feel
Taste	Sweet

**EJUMULA**  
Country of origin: Uganda  
Pedigree: Landrace

**2**

An overview of the attributes of some recently released OFSP varieties is shown in Table 3.1.

**Table 3.1 Attributes of some orange-fleshed sweetpotato varieties**

Variety Info	Name	Bela (IIAM-CIPBD004)	Namanga (IIAM-CIPBD002)	Zondeni	Chipika	Kabode	Vita	CRI-Apomuden
	CIP No:	In process	In process			CIP100200.4	CIP100200.3	CIP440254
	Country of origin	Mozambique	Mozambique	Malawi	Malawi	Uganda	Uganda	Bangladesh
	Pedigree	UW 119 x OP	UW 119 x OP	Local	OPV Kenya (SP/NO)	SPK004 x OP	SPK004 x OP	Unknown
Growth characteristics	Canopy or plant type	Spreading	Semi-erect	Spreading	Spreading	Semi-erect	Semi-erect	Spreading
	Leaf	Green mature and young leaves, 5 moderate lobes	Green old leaves, green young leaves with purple margins, 5 slight lobes, green leaf stalk	Green	Green	Green, immature leaf, light purple	Green, immature leaf, light purple	Green, immature leaf, purple
	Vine	Light/ pale green; short (2-3 cm) internode lengths	Green vine, short (2-3cm) internodes, 4-5 vine diameter	Green	Green	Green, purple tip	Green, purple tip	Green
	Flowering	Sparse	Early and profuse	Rare	Sparse	Sparse	Sparse	Moderate
	Major agronomic attributes	Maturity period (months)	5	5	6	5	4	4
Root yields (t/ha)		25.9	19.3	8-16	25-30	5-35	8-28	20
Adaptability		Wide	Wide	High rainfall		Moderate to high rainfall	Moderate to high rainfall	Wide
Resistance to pests		Resistant to weevils	Resistant to sweetpotato weevil	Tolerant	Tolerant	Susceptible to weevils	Susceptible to weevils	Susceptible to weevils
Resistance to diseases		Resistant to SPVD	Resistant (1.5 mean score)	Tolerant	Susceptible to Alternaria	Resistant to SPVD	Resistant to SPVD	Moderately resistant to SPVD
Root characteristics	Root shape	Long elliptic	Long elliptic	Long	Long	Long irregular or curved	Obovate	Long irregular
	Root skin colour	Cream	Cream	Pale orange	Pale orange	Purple-red	Purple-red	Red-orange
	DM (%)	27.5	27.0	30	30	30.5	30	21
	Flesh colour	Orange, (18 colour chart)	Intermediate Orange (20 colour chart)	Orange	Orange	Dark orange	Intermediate orange	Orange with yellow stripes
	B-carotene (fwb)	31.4 mg/100g	33.2 mg/100g	8.9mg/100g	3.9mg/100g	11.0 mg/100g	11.0 mg/100g	32.8-46 mg/100g
Sensory characteristics	Colour of boiled roots	Deep orange (27 colour chart)	Intermediate orange (25 in colour chart)	Orange	Pale orange	Dark orange	Orange	Orange
	Texture of boiled roots	Moist to intermediate	Intermediate	Dry	Moderate dry	Moderately dry	Moderately dry	Moist, soft mouth feel
	Taste	Good (mean score 3.6; score 1-5)	Fairly good (mean score 3.4; score 1-5)	Very good	Good	Good	Good	Moderately sweet
Importance	Released in which countries	Mozambique	Mozambique	Malawi	Malawi	Uganda, Kenya	Uganda, Kenya	Ghana
	Parent in crossing block	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	Commercial variety	Yes	Yes	Yes/no	Yes/no	Yes	Yes	Yes
	Home food/ food security	Yes	Yes	Yes	Yes	Yes	Yes	Yes

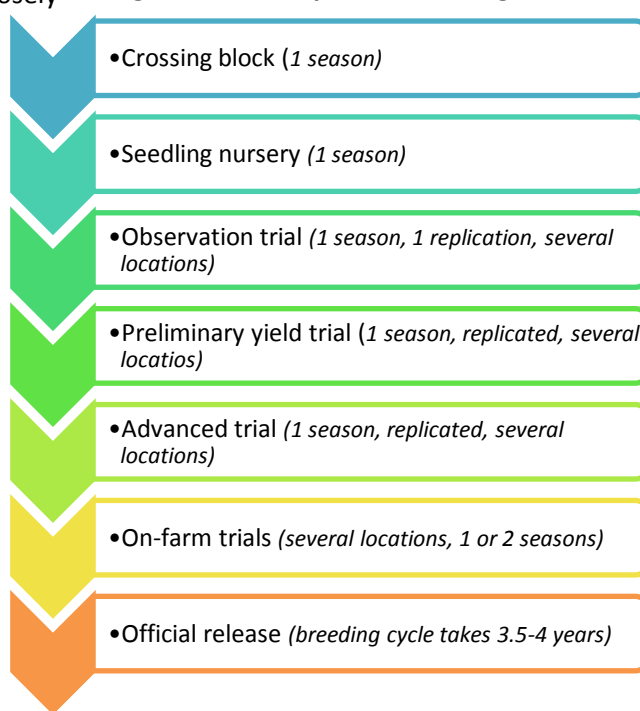
### 3.3 How to access and test different sweetpotato varieties

There are many ways that farmers can access new varieties to test in their own fields.

- **Neighbours:** They might know of a neighbouring farmer who shared some very delicious sweetpotato with them which they would like to try, and so could ask for, swap or purchase some of the planting materials of that variety to then test in their own field.
- **Agricultural extension or NGO office:** The local agricultural extension office and an agricultural NGO office are both places where farmers can ask whether there are any new sweetpotato varieties available for testing.
- **Traders:** Local and long-distance traders can also be asked, and might even help bring some of the planting materials of varieties with good marketing characteristics that they would like farmers to grow.
- **Research station:** If there is a research station nearby, this will likely be a source of new varieties for testing.
- **Specialized seed producers:** In many communities there are a few farmers who maintain and produce planting materials.

Sweetpotato breeding programs are working closely with farmers and consumers to develop and select new varieties in many countries in Sub-Saharan Africa; using seed from crossing blocks, from varieties and advanced breeding clones introduced from other countries, or from farmers' varieties collected within their countries. An overview of the main steps of the sweetpotato breeding scheme is shown in Figure 3.3. Breeders in CIP work closely with the national programs through breeding Support Platforms in East, West and Southern Africa to strengthen regional sweetpotato breeding efforts and to ensure smooth international movement of sweetpotato germplasm, in line with quarantine regulations. NGOs, CBOs, extension workers and individuals interested in accessing released varieties and promising materials for testing should contact the appropriate agricultural research station.

**Figure 3.3 Sweetpotato breeding scheme**



The next section presents the protocol for conducting on-farm participatory testing of sweetpotato varieties and is currently used by CIP and partners in Sub-Saharan Africa.

#### 3.3.1 Protocol for on-farm participatory testing of different sweetpotato varieties

##### Background

While sweetpotato breeding and seed dissemination efforts are expanding in Sub-Saharan Africa, it is probably true that most production is still based on local farmers' varieties. This may be because improved varieties have not yet reached farmers, but it may also be because of problems with the released varieties which lead to their rejection or abandonment by farmers. For example, if there is no market demand for OFSP, or if farmers and consumers are not sensitized to the special uses and characteristics of OFSP, then farmers may not continue to grow them. Also, if plants are not vigorous enough to survive over a long dry season, new varieties may be lost, while farmers' varieties persist. It is important for any variety selection and dissemination to have a very clear understanding of the

needs of farmers and consumers. A way to ensure this is to use a participatory approach. This can be done from the very beginning stages of the breeding process, which is called participatory plant breeding. A successful new variety, Tomulabula (NASPOT 11), was recently developed in Uganda using this approach with very experienced sweetpotato farmers. A more common approach is to evaluate promising materials and released varieties with farmers in on-farm trials. This is called participatory varietal selection.

A recommended procedure for participatory variety testing is presented below.

*On-Farm Participatory Sweetpotato Variety Testing Aims to:*

- Introduce the breeders varieties to farmers, and so can be an initial step in variety dissemination
- Test the performance of promising varieties under farmer growing conditions and researcher-farmer management
- Test farmers' acceptance and ranked preference of the varieties for yield and quality attributes (including taste tests)
- Help breeders obtain feedback (in terms of what farmers like in a variety)
- Build farmers' capacity in assessing varieties and experimenting



### *Methodology*

**Step 1: Situation analysis.** Before starting on-farm sweetpotato varietal testing researchers should carry out a general situation analysis to learn about sweetpotato in the focal farming and livelihood systems. Very often this step is missed because researchers feel they can depend on the knowledge of extension agents or local partners to understand the context. However, in many cases extension agents lack an accurate understanding of many issues particularly related to the socio-cultural context. The situation analysis should investigate gender and diversity issues, including the roles and responsibilities of men and women in sweetpotato production. A tool for carrying out a gender situation analysis is shown in Appendix 11.

**Step 2: Identification of local partner(s) and areas for on-farm trials.** Local partners can facilitate the implementation of the on-farm trials, and may be NGOs, CBOs or local government extension staff working in different target areas. Local partners already involved in agriculture development, human nutrition and health programs may be easier to work with. When selecting the areas for on-farm trials, try and include a range of different agro-ecological (rainfall, soil type, temperature) and socio-economic conditions (better-off farmers, poorer farmers, areas with good road and market links and those without, different cultural groups, different genders). Make sure you clarify the aims of the on-farm trials, work plans and roles with the local partner(s).

**Step 3: Identification of farmers or farmers' groups:** The local partner can identify which farmers or farmer groups would be good to work with, this may include groups they already work with or new farmers. Ensure they include a range of agro-ecological and socio-economic conditions (see Box 3.1). Select farmers on the basis of gender and diversity with regards to the roles they play, wealth status, ethnicity and age. This does not mean just involving one woman or man. The proportions or gender representation should be representative of those growing sweetpotato in the community. This also applies to ensuring the farmers selected are representative of the local wealth structure e.g. 30% poor households, 60% medium wealth households, and 10% wealthy. Where women are the major producers of sweetpotato but men contribute some labour, it is important to work directly with women rather than just with men in their role as head of households.

Working with farmer groups *that are well organized* can accelerate varietal dissemination. Otherwise, it is often better to select individual farmers to conduct the trials, with each farmer serving as a replicate. Remember that you are likely to lose some sites during the trials (due to drought, floods or illness, etc.) so strive to have at least 10 farmer sites for a given agro-ecology.

In some countries, it may be useful to have the farmer sign a contract committing to participate (*Appendix 3.4 provides a sample contract*). Normally the arrangement is that farmers are provided with the planting material for free and the roots

after measurement and removal of a few for tasting belong to them as compensation. Expectations of both farmers and researchers should be discussed and agreed upon at all stages of trial planning and planting, and can be included in the contract.

**Step 4: Planning for the trials with the farmers:** A meeting should be scheduled with the entire group of farmers or group leaders to be involved. It is good to include a local leader as they can help influence adoption of sweetpotato technologies later. The meeting can be done by the local partner alone or together with the researcher. During the meeting explain or discuss: a) the aims and underlying activities, including trial design; b) contributions required from the farmers (e.g. land, hoes, labour, trial management, and selection of check variety) and from researchers (vines, visits, training, leaflets); c) farmers expectations, some of which may not be met; d) plan of action (what has to be done, by who, how and when) through the planting period, field growth period, harvesting period and post-harvest period. It is important to ensure that the meeting is participatory and should help to generate readiness for trials among the farmers. Land for the trial should be identified and modalities for its preparation agreed on. Where women are the major producers, be open to inviting their husbands to the planning meeting to get their buy-in and alleviate any suspicions about the proposed trials. Arrange to hold the meeting at a time that is convenient to women.

**Step 5: Planting the trial:** Remind the farmers about the trial aims and design.

1) Do not test more than eight varieties at a time. A plot size of about 30 sq metres arranged in 5 rows 6 metres long per candidate variety should be used (Figure 3.4). Leave a spacing of 1 metre between rows. Ridges should be at least 40 cm high. In each row/ridge, vines should be planted approximately 30 cm apart. Thus 100 cuttings are required per plot. Additional cuttings (depending on the supply of material) may be planted at the end of the row to use for gap filling.

2) Explain to the farmers:

a) The middle 3 rows cannot be harvested during the growing period, as they need to be assessed with the researcher present to get good measurements of the yields (Figure 3.5). The farmer will

### **Box 3.1 Important criteria for selecting the farmers**

*Include:*

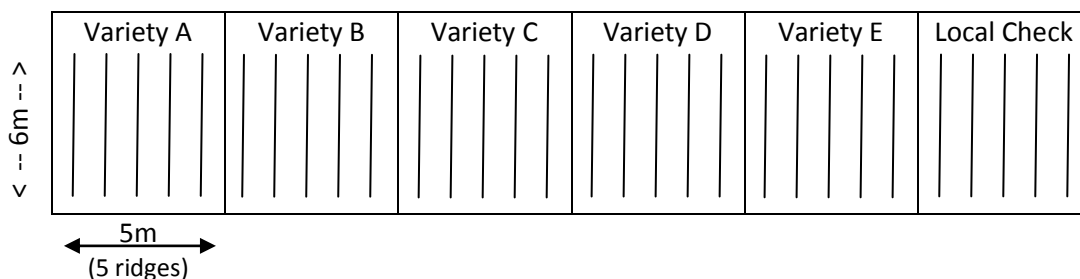
- Good coverage of agro-ecological and socio-economic diversity among the selected farmers
- Someone willing to manage and host the trial and have visitors come to her/his farm on the evaluation days
- Assess whether there is sufficient labour (own or hired) and land to undertake the trial using the agreed management approach
- Located in an accessible area (not too far from a major road)
- Experienced sweetpotato grower in good health
- Soil for plot to be used in the trial should be homogeneous
- Being aware if the farmer has had problems in the past with animal destruction and theft
- Willingness to invest in sweetpotato production after the trial

keep all of the roots except 10 roots that the researcher will need for lab assessments, and roots that will be cooked for the taste test.

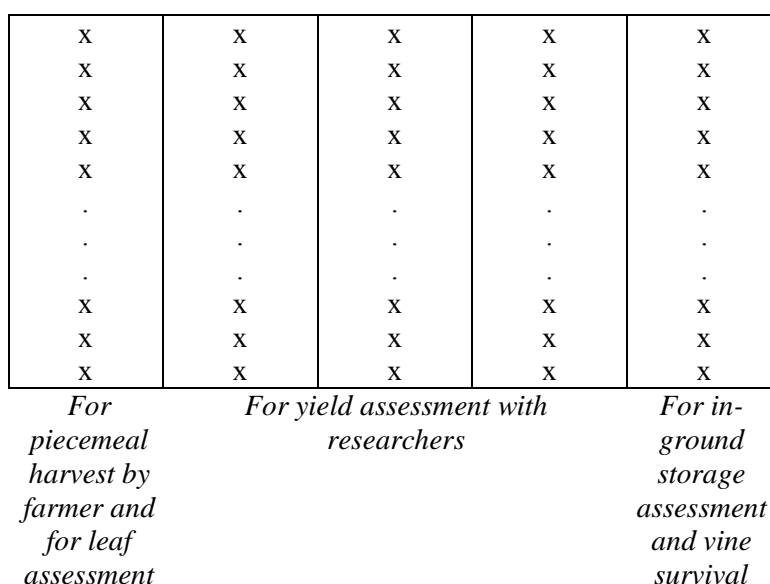
b) The 1<sup>st</sup> row on the outside can be used by the farmer for piecemeal harvesting. This row will also be used to obtain leaves for evaluating quality when cooked (*for countries in which leaves are eaten as a vegetable*).

c) The last row must not be piecemeal harvested, because it will be used to assess in-ground storability over a 3 month period.

**Figure 3.4 Example of trial layout**



**Figure 3.5 Example of individual plot layout (5 rows, each 6 m long and 1 m apart)**



Nearly similar plot sizes and layouts can be used in areas where farmers plant sweetpotato on mounds. Usually these are spaced about 1 metre apart. Three vines are usually planted roughly 30 cm apart on the top of the mound. The researcher should guide but let the farmers plant the vines their own way.

Further explanation must be made of what is expected of the farmers and a schedule of when visits will happen should be left with the farmer.



**Step 6: Monitoring of the trial** is done by all the stakeholders (farmers, local partners, researchers). The purpose is to: a) check on the establishment and ensure timely gap filling; b) ensure timely weeding of the trials by the farmers and c) ensure general good progress of the trials. Note that monitoring visits are typically combined with evaluation (or data collection) visits. It is worth reminding the farmer in advance of the date that you will be visiting. Briefly walk through the trial with the farmer and discuss any observation s/he has noted. Record keeping of results from the trials is very important. Standard forms are available to allow researchers to record their observations, and also to allow the collection of farmer assessment of variety performance. These forms are presented in the Appendices 3.5a, b and c, and can also be downloaded from the Sweetpotato Knowledge Portal. Always explain to the farmer what you are writing and why.



**Step 7: Evaluation of the trials:**

- a. **Virus assessment and 1<sup>st</sup> weeding:** The first weeding should be done 3 weeks after planting and farmers should be instructed to do so. If funds are sufficient, a visit can be made at 3 weeks. If not, combine a visit to assess virus incidence and weeding at 6 weeks. This assessment will be done by the NGO, extension or research partner helping to supervise the trial. However, the farmers and other local partners should be available so the researcher can show them virus symptoms if present, and they can discuss other initial farmer impressions of the varieties.
- b. **Leaf taste-test evaluation:** Three months after planting, leaves or leaves and petioles (depending on local practice) are harvested from each candidate variety and prepared for consumption using the local preparation method.

While the leaves are still on the plant, ask the farmers to evaluate: Will this be good for cooking? (Yes/No). Then ask them why.

Then harvest leaves from the border row/ 1<sup>st</sup> row of each variety so as not to influence the root yield of the other 4 rows. You should note what local practice is in terms of which leaves are selected (size/location) and whether the petiole is also consumed. Leaves should be cooked in a simple local fashion to generate relevant results. The prepared leaves are evaluated for 1) taste, 2) appearance, and 3) texture, using colour card system described for roots below (*see Stage 2 below*). Then conduct a pair-wise comparison of the cooked leaves from the different varieties being tested in order to stimulate discussion about the difference between the varieties and to rank them in order of preference (*use Forms 5C and 5C1 in Appendix 3.5c*).

- c. **Final evaluation:** Three stages of this evaluation are done at root harvesting time, followed by a fourth stage which sets up the in-ground root storability assessment.

**Stage 1. Quantitative root assessment:** Two weeks prior to harvest, remove the foliage from the central row of each plot in order to evaluate/demonstrate the effectiveness of this practice for pre-harvest curing. Between 3 and 5 months after planting date (*depending on normal practice in a given country and for the given variety - if these are new improved varieties the researcher should provide details on the normal harvest period for each variety in each specific region*), three middle rows/ridges of each of the plots are harvested and quantitative data recorded for standard harvest using standard recording forms (Form 4C, Appendix 3.5b). Researchers will keep 5 roots from the middle row (cured) and 5 roots from the 2<sup>nd</sup> or 4<sup>th</sup> row to take back to the station to evaluate shelf-life. The shelf-life evaluation assesses 1) weight, 2) sprouting, and 3) rotting on a bi-weekly basis.

**Stage 2. Participatory field variety evaluation:** This is done with farmers using cards to indicate their observations on different attributes of each of the test varieties. Farmer assessment of foliage and sweetpotato virus disease (SPVD) susceptibility both need to be done before storage root harvest; indeed this should be done well before harvest, for example, when the leaf taste test is done. At least 15 male farmers and 15 female farmers should participate for good results.

To facilitate the evaluation three types of cards (Green, Yellow and Red) are recommended.

*Green card* means very acceptable;

*Yellow card* means give it another chance or moderately acceptable; and

*Red card* means reject or not acceptable.

These colour cards were chosen because they can be related to those used by referees at football matches, making the concept easy to grasp. To address gender issues, provide two batches of the coloured cards and label one batch with letter **'M'** so as to differentiate it. The **'M'** cards are used for men, the ones without it for the women.

Advanced preparation for the harvest is important in order to ensure quality data is collected. Make sure you have the field trial layout plan to remind you of which varieties were planted in which plots. If any of the plot labels have been lost, create new ones.

Just before you start to harvest, use your field trial layout plan to correctly place pre-labelled bags bearing the variety name and the attribute being assessed on each variety/plot (e.g. Variety X: Root Yield or Variety Y: Root Yield). This is very important as it ensures that varieties are not mixed up. Assess one trait at a time, if more than one trait is to be assessed then place the second lot of bags for that trait on the plot as well e.g. Variety X: SPVD resistance, and Variety Y: SPVD resistance. Farmers tend to tire if more than six different attributes are evaluated per variety. The evaluation is then done by considering each variety at a time. The performance of each variety is assessed by each farmer individually by assigning and putting one card only in the bag.

Farmers are given sufficient cards of each colour to allow assessment of each variety for each attribute (*if you have 8 varieties being evaluated, and you are going to assess 6 attributes of each variety – then each farmer will need 48 green cards and 48 yellow cards and 48 red cards. If you have 40 farmers doing the evaluation you will require a total of 1920 green cards, 1920 yellow cards and 1920 red cards – a lot of cards!*). Decide beforehand which attributes you are going to assess and label the three different coloured cards per attribute, ensuring there are enough to evaluate each variety for all the attributes. Each farmer puts into the bag one card that shows the level of performance of the variety per attribute being assessed. When the exercise is completed per individual variety, then bags should be collected and bundled by attributes.

Assessment at field level could be done on all or some of the following attributes depending on what farmers consider important: The question posed to the farmers could be: ***“Give your opinion by using the provided cards on the following attributes”:***

- The ability to produce enough planting material (foliage production);
- The ability to resist diseases, especially SPVD;
- The ability to resist pest damage (mainly weevils);
- The yielding ability (i.e. number and size of mature roots);
- The attractiveness of the root skin colour. Probe more to understand which colour(s) are most preferred and why?
- The attractiveness of the root flesh colour? Probe more to understand which colour(s) are most preferred and why?
- What is your overall opinion on the acceptability of this variety?

After the farmer evaluators have finished, the cards in each bag should be separated and counted by colours and sex. The information is recorded in the data sheet (Form 5A. Appendix 3.5a).

At the end of the individual assessment, on a group basis, the farmers should be asked to tour and select the best three varieties and worst three varieties respectively, and give reasons for their choices. Then for the top five varieties, use pair wise comparison (Form 5A1. Appendix 3.5a), whereby every variety has a chance of being compared with all others. In pair wise comparison, those varieties preferred most frequently are considered most acceptable.

**Stage 3. Consumer acceptability assessment:** Roots from each variety should be labelled; boiled and small pieces are then served on plates for 'blind' assessment using A, B, C etc or 1, 2, 3 etc. to code each variety. Usually boiling them for 40 minutes in a little water is enough to cook them. Choose moderate sized roots of similar size for the test. The use of cards in the consumer acceptability exercise is done in the same way as the field evaluation. The bags for receiving the cards are labelled with a name of the variety and the attribute being assessed. The group should be divided into women and men. Before starting the exercise, review what the attributes are, emphasizing that it is how *they* feel *individually* about the particular variety. The question posed to the evaluators could be: ***"Give your opinion by using the colour cards provided on the following root attributes"***.

- Attractiveness of the colour of the boiled root (root flesh appearance);
- Taste when chewed (Taste of the root) (*some will prefer sweetness, some not*);
- Flavour/ aroma in the mouth (Smell/ flavour);
- Flouriness/ starchiness (Dryness);
- Consistency of the root texture? (Fibrousness);
- What is your overall opinion on the acceptability of this variety?

For convenience, all the attributes of one variety should be assessed before moving on to the other. In the exercise, several bags labelled with different attributes are passed round one after another for the farmers to put in their cards. When all the varieties have been assessed, the bags are then separated based on the attributes. The information is recorded in the sample sheet (Form 5B. in Appendix 3.5b).

At the end of the individual assessment, on group basis, farmers are asked to select their best five varieties and give reasons. Then for those 5 varieties, a pair wise comparison should be done by farmers so that again every variety will have an equal chance of being compared with the others (Form 5B2. Appendix 3.5b). Reasons for varieties being ranked best should be captured by the evaluators.

**Stage 4: In-ground storability assessment:** On the harvest day, hill up the soil on the last row, covering any exposed roots and pack the soil down using your feet. After a further 3 months, return for the final visit and assess for each variety: 1) vine survival, 2) number of roots, 3) number of roots infested with weevil or rotted, 4) weight (kgs) and 5) raw taste. *Note: some researchers prefer to cut the vines back at the main harvest time to cure and protect the roots during the in-ground storability period.*

### Key visits

The visits to be made by the researcher depend on the above steps. More visits are needed in a new area than in an area where the on-farm trials have been done in the past. If the farmers are very experienced with on-farm trials, it is possible to combine two or all of the first three visits.

- Visit 1: to meet with local partners (identify areas and meet local partners) --- The researcher visits the local partner(s) to elicit their involvement and support for the on-farm trials in the target area. The objectives and work plan of the trials as well as roles should be explained or discussed during the visit;
- Visit 2: to identify farmers;
- Visit 3: to plan trials with farmers;
- Visit 4: to plant the trial;
- Visit 5: *(six weeks after planting)* to do the virus assessment and weeding check (farmers will need to be invited);
- Visit 6: *(three months after planting)* to do the raw and cooked leaf evaluation;
- Visit 7: *(two weeks before root harvest)* to cut vines for in-ground curing on the central row but not on the other two rows being assessed and set up invitations for farmer participation in the field and root tasting evaluation;
- Visit 8: to harvest the central three rows of each variety and to conduct the field and root tasting evaluation, and to set up the in-ground storability assessment; and
- Visit 9: *(three months after the main harvest and assessment)* to conduct the in-ground storability assessment.

### 3.4 Gender and diversity aspects of sweetpotato varietal selection and characteristics

A thorough discussion of gender and diversity aspects in relation to sweetpotato is presented in Topic 11. Key gender and diversity issues relevant to sweetpotato varietal selection and characteristics are woven throughout the text of Topic 3 and highlighted below.



Females and males are often interested in different characteristics of sweetpotato due to their roles and responsibilities. For example, women tend to be more interested in cooking qualities of the roots such as low oil absorption during frying and the tendency of cooked roots to crumble compared with men. In situations where men are responsible for root sales, they are more likely than women to be interested in market-related characteristics.

It is important that a sweetpotato needs assessment is done prior to starting sweetpotato work in a new location, in order for the development workers to understand the different roles sweetpotato plays in the livelihoods of the different groups in the community (e.g. men and women, children, different wealth, age, and religious groups). Extension workers may lack accurate understanding of the relevant socio-cultural issues.

Based on the findings of the needs assessment and the project's goals, on-farm trials can then be developed involving a diverse and representative group of the community at all stages of the planning and implementation. The farmers involved in the trials should be selected on the basis of gender with regards to the roles they play, wealth status, ethnicity and age. This does not mean involving just one woman or man. The proportion of gender representation should be representative of those growing sweetpotato in the community. This also applies to ensuring the farmers selected are representative of the local wealth structure e.g. 30% poor households, 60% medium wealth households, and 10% wealthy. Where women are the major producers of sweetpotato but men contribute some labour, it is important to work directly with women rather than men in their role as head of households. However, their husbands should be invited to the planning meeting in order to get their buy-in and alleviate any suspicions about the proposed trials.

Meetings and field activities should be arranged at locations and times that are convenient and safe for those involved, including women.

### 3.5 Ideas for sweetpotato varietal selection and characteristics learning-by-doing activities

These learning by doing activities have been designed to provide hands-on discovery learning opportunities for the participants of the 10 day 'Everything you ever wanted to know about sweetpotato' ToT course. We hope by learning about sweetpotato in a hands-on way, these trainers will then train others using a practical learning by doing approach.



The full 10 day ToT course programme is described in Topic 13 of this manual. The following activities occur on day 2 of the 10 day ToT course, an overview of day 2 is given below. However, we hope these activities will also be used by trainers as stand-alone learning activities and as part of other training courses.

Day	Topics	Intended Learning Outcomes	Activities
2	Different varieties of sweetpotato and their characteristics	<p><i>Participants will:</i></p> <ul style="list-style-type: none"> <li>- Understand key differences between sweetpotato varieties</li> <li>- Know about the key characteristics of at least 3 sweetpotato varieties suitable for their area/ region</li> <li>- Be able to help farmers identify the key characteristics they are looking for in a sweetpotato variety</li> <li>- Understand that varietal preference differs between people</li> <li>- Be introduced to why care during harvesting is important for sweetpotato</li> <li>- Know how to conduct a variety ranking test (using red, yellow and green cards)</li> <li>- Be experienced in conducting a taste test (using red, yellow, and green cards)</li> </ul>	<ul style="list-style-type: none"> <li>- <i>Activity 3.5.1: Spot the difference.</i> Field activity to: identify characteristics of different sweetpotato varieties in a nearby field; to discuss with the farmer why s/he grows each of them; and to then use the roots from these different varieties to conduct a taste evaluation (<i>see 3.5.1</i>) [2hr 45mins]</li> <li>- <i>Activity 3.5.2: Selecting sweetpotato varieties.</i> Group discussion on key factors differentiating sweetpotato varieties and which are important for which reasons. Participants then create promotion posters/ training materials for the main sweetpotato varieties grown or suited to their location (<i>see 3.5.2</i>) [70mins]</li> <li>- <i>Presentation 3.</i> Covering the natural diversity of sweetpotato; defining characteristics of different sweetpotato varieties; and methods for on-farm testing of different sweetpotato varieties</li> </ul>

### 3.5.1 Spot the difference

*Intended Learning Outcome:* Participants will:

- Become familiar with attributes of importance to sweetpotato farmers, and with farmers' perceptions of the attributes of their varieties
- Be able to identify sweetpotato varieties using standard descriptors
- Be able to conduct gender-sensitive consumer taste tests

*Timing:* 2 hours and 45 mins / half day

*Advanced preparations:* Identify a nearby field with several varieties of sweetpotato growing in it, and meet the farmer and see if they are agreeable to their field being visited by the participants, themselves being interviewed by the participants, and some (try and minimize the number) of the plants being dug up to see the root characteristics and to remove some roots for tasting, possibly 1-2 plants per variety. The farmer will need to be compensated for the roots that are used.

*Materials:* Nearby field with several varieties of sweetpotato growing in it and which the participants can harvest some roots (*note: this activity could also be done in an on-station field but this would then omit the opportunity for participants to learn why farmers grow those varieties*), flip chart, marker pens, A4 plain white paper, pencils, erasers, participants notebooks, sufficient copies of the handout on sweetpotato descriptors (Appendix 3.1) and on estimating the beta-carotene content through flesh colour of orange fleshed sweetpotato varieties (Appendix 3.2), sufficient copies of the form for participatory storage root taste evaluation (Forms 5B and 5B2 Appendix 3.5b), cooking stoves and fuel, pans, water, matches, knives (*note: taste test could be done in the training room*).

*Suggested steps:*

1. Walk to a nearby field with several varieties of sweetpotato growing in it. Greet the farmer and remind her/him that as per the arrangement the course participants will move around the field and try and identify and then sketch different sweetpotato varieties that are growing there. They would then like to ask her/him about her/his sweetpotato variety choices. In groups of 5 people the participants should move around the field and locate at least 3 different varieties of sweetpotato. Each participant should sketch the leaf and root shapes of the different varieties, and note down any colour differences between them. Using the sweetpotato descriptors handout they should then identify the shape of the sweetpotato roots and leaves that they have drawn. [40 mins]
2. The participants should then ask the farmer about why she/he grows a range of sweetpotato varieties, what the different survival rates, growth durations, growth habits, climatic preferences, root and leaf tastes and marketable traits of the different varieties are. This is best done in small groups if possible. Participants should make a note of the farmer's answers and how they relate to the varieties they have drawn. Encourage the participants to use open-ended probing questions to learn more about the different varieties. [20 mins]
3. In their small groups the participants should discuss and describe the different varieties of sweetpotato in the field. [15 mins]
4. The participants should harvest some roots of each variety to taste together with the farmer/s, and then record the different taste aspects of each variety using the method described in Topic 3.3 of the manual (with the red, yellow and green cards) and use the Forms (5B and 5B2) in Appendix 3.5b and their notebooks to record their findings. *If possible try and ensure one of the varieties being tested has low dry matter content.* [1.5 hours]

*If possible:* Some roots should be harvested without care (so they become damaged) and some with care. Do not boil all of these roots -- keep several of each variety of them on a table in the training room, to use for the harvesting discussion on day 9 of the ToT. If REALLY organized in advance, you could have some roots that were field cured prior to harvest, and you could also carry these back to the training room so that the effect of curing could be assessed by the participants when they come to study harvesting on Day 9.

### 3.5.2 Selecting sweetpotato varieties

*Intended Learning Outcome:* Participants will:

- Know and describe key characteristics of at least 3 sweetpotato varieties suitable for their area/region
- Be able to converse intelligently (listen) with farmers about key characteristics they look for in a sweetpotato variety
- Be able to develop OFSP promotional materials referring to key characteristics of importance to farmers and consumers.

*Timing:* 70 mins

*Materials:* Flip charts (at least 1 page per participant); coloured pencils including plenty of green, brown, orange and yellow ones; CIP OFSP catalogue.

*Suggested steps:*

1. Facilitate a group discussion on the key factors differentiating sweetpotato varieties and which are important for which reasons; make notes of key points on a flip chart [10 mins]
2. Then for the main two sweetpotato varieties grown in the participants work locations, ask them each to use half the flip chart page to create an advertising poster showing and describing the different characteristics of each of these varieties. The facilitator should push them to think of different characteristics they could include:
  - Leaf shape and colour
  - Time to root maturity
  - Root size, colour (skin and flesh) and shape
  - Resistance to diseases
  - Root yield
  - Dry matter content
  - Taste
  - Texture
  - Marketing appeal [30 mins]
3. Then ask them to each add into their posters (on the empty half of the page) two new varieties they have learnt about during the ToT, which they feel could be promoted in their work locations (and why, include gender aspects). (*Note: These flipchart style posters could act as training materials when this trainer then trains other people*). The flipcharts should then be posted up around the training room as a small exhibition and to enable the facilitator to see which characteristics and new varieties have been picked up on by the participants. [20 mins to complete their posters, then 10 mins for the exhibition]

### 3.6 References used

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*Notes on: **Sweetpotato Varietal Selection and Characteristics***

