ON-FARM PARTICIPATORY VARIETY TESTING --- PROTOCOLS (May, 2012)

Introduction

On-farm trials are an effective way to improve client-orientation of breeding programs by formalizing farmer involvement in the variety testing process. They can also be an important first step in variety dissemination, since data from on-farm trials are usually required for official varietal release, and farmers will be keen to obtain planting materials of varieties that perform well in trials. Standardization of procedures is important for easy and meaningful analysis and presentation of results. However, circumstances, including population density, the presence of organized farmer groups, their previous experience with sweetpotato, and budgets can dictate varying approaches to on-farm variety testing. The set of procedures below present a standard method for on-farm sweetpotato variety testing to be used (with slight variation) by sweetpotato breeding programs in SSA during the 2011/2012 season.

Background

Often there is a mismatch of what the researchers and farmers (end users) consider as the best variety. This probably explains the low adoption rates for some of the research generated varieties and the dominance of farmer varieties in some areas. There are also cases of varieties adopted by farmers having previously been rejected by the breeding programs. On-farm variety testing is aimed to bridge the gap during the variety development.

Objectives

- To introduce the varieties to users (farmers) – initial step for variety/technology transfer
- To test performance of promising varieties under farmer growing conditions and researcher-farmer management
- To test farmers' acceptance and ranked preference of the varieties for yield and quality attributes (including taste tests)
- To obtain feedback (in terms of what farmers like in a variety) to breeders
- To build farmers' capacity on variety assessment (experimentation)

Methodology. CloneSelector2.0 (available at www.sweetpotatoknowledge.org) provides forms which should be used to record information on trial establishment and management, pre-harvest evaluations, harvest data, and other assessments conducted by researchers. However, at this time it does not contain forms to handle farmer participatory assessment. These forms are provided in Appendix 2. All forms are also provided as an excel file, but cooperators are strongly encouraged to use CloneSelector2.0 to record trial information whenever possible.

Step 1: Identification of local partner(s) and areas for on-farm trials. Local partner(s) and targeted areas are interdependent ---- there are different partners in different areas. Local partners can facilitate the implementation of the subsequent steps of the on-farm trials, and can 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. Selection of areas for on-farm trials should prioritize capturing the range of different agro-ecological (rain, soil,

temperature) and socio-economic conditions (better-off and poorer farmers) of the target areas. It is important to clarify the objectives, work plans and roles for the on-farm trials with the local partner(s).

Step 2. Identification of farmers or farmers' groups: This can be done by the researcher and the local partner or the local partner alone depending on the level of collaboration and mutual trust. For example, the researcher may depend on a local partner with whom he has worked in the past to identify farmers. On the contrary, the researcher may need to work with the newly identified partner to identify the groups. Individual farmers or farmers' groups may be selected, taking gender into account. We should aim to have at least ½ of the on-farm trials with women. Working with farmer groups *that are well organized* can accelerate varietal dissemination. Otherwise, it is better to select individual farmers to conduct the trials. Each farmer serves as a replicate. Remember that you are likely to lose some sites during the trials (due to illness, etc.) so strive to have at least 10 sites for a given agro-ecology.

In selecting farmers, pay attention to the following criteria:

1. Willing to host the trial and have visitors come to her/his farm on the evaluation day

2. Assess whether there is sufficient labor and land to undertake the trial for the agreed upon management approach

3. Located in an accessible area (not too far from a major road)

4. Experienced sweetpotato grower in good health

5. Soil for plot used in the trial should be homogeneous

6. Whether the farmer had problems in the past with animal destruction and theft

In some countries, it may be useful to have the farmer sign a contract committing to participate *(Appendix 1 provides a sample contract)*. Normally the arrangement is that farmers are provided the planting material free and the roots belong to them as compensation. At any rate, expectations of both farmers and researchers should be discussed and agreed upon at all stages of trial planning and planting. These expectations can be included in the contract.

Step 3. Planning for the trials with farmers: This is an important step and a meeting should be scheduled with the entire group of farmers or group leaders. The meeting can be done by the local partner alone or together with the scientist depending on the level of confidence and trust the researcher has built in the local partner --- but not always necessary if the first steps 1 and 2 were well done. During the meeting explain or discuss: a) the objectives and underlying activities, including trial design; b) contributions from the farmers (e.g. land, hoes, labour, selection of check variety, etc.) and from researchers (vines); c) farmers expectations, some of which may not be met; d) plan of action (what has to be done and by who) up to planting date. 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 put in place and agreed on.

Step 4. Planting the trial: The researcher should once again explain the trial objectives and design.

1) Plot size of about 30 sq meters arranged in 5 rows 6 meters long should be used per candidate variety. 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.

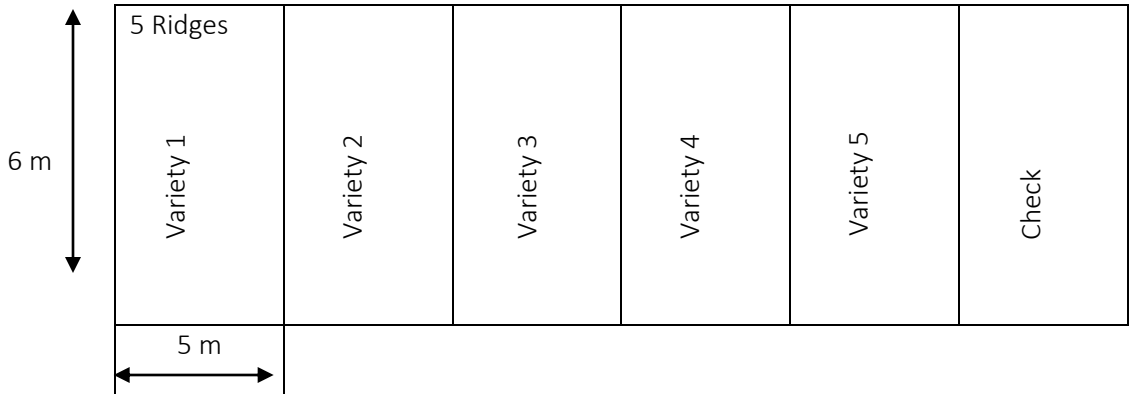
2) Explain to the farmers:

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. The farmer will keep all of the roots except 10 roots, that the researcher will need for lab assessments and roots that will be cooked for the organoleptic assessment.

b) The 1st 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 human leaf consumption is significant*).

c) The last row must not be piecemeal harvested, because it will be used to assess in-ground storability over a 2 month period.

Example of trial layout



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

x	x	x	x	x
x	x	x	x	x
x	x	x	x	x
x	x	x	x	x
x	x	x	x	x
.	.	.	.	.
.	.	.	.	.
.	.	.	.	.
x	x	x	x	x
x	x	x	x	x
x	x	x	x	x

For piecemeal harvest by farmer | *For yield assessment with researchers* | *For in-ground storage*

Nearly similar plot sizes can be used in areas where farmers plant sweetpotato on mounds. On the mounds, three vines are planted in a triangular fashion approximately 30cm apart. The researcher should guide but let the farmers plant the vines their own way and replicate with more farmers (4 – 10 farmers) depending on the number of groups. You will need 33 mounds, planted with 99 cuttings in total. From the middle of one mound to the middle of the next mound, there should be a distance of 1 meter.

Further explanation must be made of what is expected of the farmers and a schedule of when you will come back.

Step 5. Monitoring the trial: Monitoring is done by all the stakeholders (researchers, local partners and farmers). 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 most often monitoring visits are combined with evaluation (or data collection) visits.

Step 6: Evaluation of the trials:

a. SPVD assessment and 1st Weeding: The first weeding should be done 3 weeks after planting and farmers should be instructed to do so. If funds are abundant, 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 researcher. However, the farmers and the local partner should be available for the researcher to be shown virus symptoms if they are present in the field. (Forms from CloneSelector 2.0 should be used for evaluation of establishment and virus rating)

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.

   Harvest from the border rows so as not to influence the root yield. 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 color card system described for roots below. Then conduct a pair-wise comparison of the cooked leaves in order to stimulate discussion about the difference between the varieties and to rank them in order of preference. (*Use forms in Appendix 2c)*

c. Final evaluation: This is a three stage evaluation done at harvesting time.

Stage 1. Quantitative 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 4.5 and 5.0 months after planting date (*depending on normal practice in a given country*), three middle rows/ridges of each of the plots are harvested and quantitative data recorded for standard harvest using standard recording forms from CloneSelector2.0. Researchers will keep 5 roots from the middle row (cured) and 5 roots from the 2nd or 4th 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 SPVD susceptibility both need to be done before storage root harvest.

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 very easy to grasp since football is played in most rural areas of SSA. 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.

Pre-labeled bags bearing variety name and the attribute being assessed should be placed on each plot/variety (e.g. Plot 1, Root Yield or Plot 2, SPVD resistance). 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. The number of farmers should be at least 15 per sex for good results.

Farmers are given cards (7 per colour per variety for the agronomic; 8 per colour per variety for the root taste tests) for the assessments. 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 varieties, 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 tolerate diseases, especially SPVD;
- The ability to tolerate 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 know which colour(s) are most preferred and why?
- The attractiveness of the root flesh colour? Probe more to know which colour(s) are most preferred and why?
- What is your overall opinion on the acceptability of this variety??

The cards in each bag should be separated and counted by colours and sex. The information is recorded in the data sheet (Appendix 1).

At the end of the individual assessment, on group basis, farmers should be asked to tour and select the best five varieties and worst three varieties respectively, and give reasons for their choices. This exercise should be done if varieties being assessed are more than ten. Then for the top 5 varieties, use pair wise comparison (Appendix 2a), whereby every variety has a chance of being compared with all others. In pair wise comparison, those varieties mentioned more frequently over others are considered acceptable.

Stage 3. Consumer acceptability assessment: Roots from each variety should be labeled; 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.

Take care to not overcook the roots, especially those with lower dry matter content. The use of cards in the consumer acceptability exercise is done in a much similar way as for the field evaluation. The bags for receiving the cards are labeled 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 provided cards 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.*
- Flavor/aroma in the mouth (Smell/ flavor);
- 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 labeled 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 as shown in the sample sheet in Appendix 2b.

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. Reasons for varieties being ranked best should be provided by the evaluators as indicated in the chart below.

Key visits

The visits to be made by the research depend very well on the above elaborated steps. They will also depend on whether you are doing on-farm trials in a given area for the first time. More visits are needed in a new area than in an area where the on-farm trials have been done in the past. In the later scenario, it is possible to combine two or all of the first three visits.

1. Visit 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.
2. Visit to identify farmers
3. Visit to plan trials with farmers
4. Visit to plant the trial
5. After 6 weeks, virus assessment & weeding check (farmers will need to be invited)
6. Trip at 3 months, for leaf cooking and evaluation
7. Visit 2 weeks before root harvest to cut vines for in-ground curing on the central row but not on the other 2 rows being assessed & set up invitations for farmer participation
8. Harvest
9. Assessment of in-ground storability over 2 months

In-ground storability: On the harvest day, cut the vines on the last row (border row). Hill up the soil, covering any exposed roots and where the vine was cut and pack the soil using feet. After 2 months,

return for the final visit and assess for each variety: 1) # of roots, 2) # of roots infested with weevil or rotted, 3) weight (kgs) and 4) Raw taste. CloneSelector2.0 has forms to handle this data.

Appendixes 1. Sample farmer contract for On-farm trial 2011 - 2012

Contract between the farmer named _____ and the researcher named _____ and the representative from the local partner organization _____.

We the undersigned:

1. Understand that the 3 middle rows of each plot will be reserved for harvesting together with the researchers/local partners, and that they will not be harvested before the agreed-on main harvest time. One row will be reserved for in-ground storage. One row will be for farmer's use to harvest as desired.

2. The farmer agrees to the following management practices:

a. To take good care of the trial plots, weeding and performing other management following the instructions agreed upon with the researcher including:

Preparing the field with 30 cm between plants on ridges, that are 40 cms high.

1st weeding after 3 weeks.

2nd weeding as needed, hilling up as demonstrated by the researcher.

b. To protect the field from animal attack through careful site selection or fencing (with bushes or other materials).

3. Understand that other farmers and members of the community will be invited for field days or at other times to observe the fields

4. Researchers will make several visits to take measurements during the growing season

5. The plot owner will own all of the roots from the harvest, except those needed for the cooking trials and the storage trials (approximately 20 roots).

6. Any other agreed upon point.

Signed and dated:

_____ _____

Farmer(s) Date

_____ _____

Researcher(s) Date

_____ _____

Local partner(s) Date

Appendix 2a. Forms for farmer participatory pre-harvest evaluation

FORM 5A. SWEETPOTATO FARMER PARTICIPATORY FIELD EVALUATION

SITE: _____ Year: Season: PAGE

TOTAL NUMBER OF FARMERS TOTAL NUMBER OF FEMALE FARMERS TOTAL NUMBER OFMALE FARMERS

		PRODUCTION OF PLANTING MATERIAL			ASSESSMENT OF SPVD RESISTANCE			ASSESSMENT OF WEEVIL RESISTANCE			ASSESSMENT OF YIELDING ABILITY			ASSESSMENT OF ROOT SKIN COLOUR			ASSESSMENT OF ROOT FLESH COLOUR			OVERALL ACCEPTABILITY		
GENOTYPE CODE	GENDER	# RED	# YELLOW	# GREEN	# RED	# YELLOW	# GREEN	# RED	# YELLOW	# GREEN	# RED	# YELLOW	# GREEN	# RED	# YELLOW	# GREEN	# RED	# YELLOW	# GREEN	# RED	# YELLOW	# GREEN
	1 - MALE																					
	2 - FEMALE																					
	1 - MALE																					
	2 - FEMALE																					
	1 - MALE																					
	2 - FEMALE																					
	1 - MALE																					
	2 - FEMALE																					
	1 - MALE																					
	2 - FEMALE																					
	1 - MALE																					
	2 - FEMALE																					
	1 - MALE																					
	2 - FEMALE																					

Group ranking of varieties for the overall field performance using pair wise comparison

	Variety					
Variety	A	B	C	D	E	F
A	X					
B		X				
C			X			
D				X		
E					X	
F						X
Total frequency per variety						
Rank						

Reasons for the high ranked varieties:

_____

_____

_____

_____

Reasons for the least ranked varieties:

_____

_____

_____

_____

Appendix 2b. Forms for farmer participatory storage root taste evaluation

FORM 5B. SWEETPOTATO FARMER PARTICIPATORY TASTE TEST EVALUATION

SITE: _____ Year: _____ Season: _____ PAGE _____

TOTAL NUMBER OF FARMERS _____ TOTAL NUMBER OF FEMALE FARMERS _____ TOTAL NUMBER OFMALE FARMERS: _____

		ASSESSMENT OF APPEARANCE			ASSESSMENT OF TASTE			ASSESSMENT OF STARCHINESS			ASSESSMENT OF FIBROUSNESS			OVERALL ACCEPTABILITY		
GENOTYPE CODE	GENDER	# RED	# YELLOW	# GREEN	# RED	# YELLOW	# GREEN	# RED	# YELLOW	# GREEN	# RED	# YELLOW	# GREEN	# RED	# YELLOW	# GREEN
	1 - MALE															
	2 - FEMALE															
	1 - MALE															
	2 - FEMALE															
	1 - MALE															
	2 - FEMALE															
	1 - MALE															
	2 - FEMALE															
	1 - MALE															
	2 - FEMALE															
	1 - MALE															
	2 - FEMALE															

Group ranking of varieties for the overall consumer acceptability of storage root taste using pair wise comparison

	Variety				
Variety	A	B	C	D	E
A	X				
B		X			
C			X		
D				X	
E					X
Total frequency per variety					
Rank					

Reasons for high ranked varieties:

_____

_____

_____

_____

Reasons for least ranked varieties:

_____

_____

_____

_____

Appendix 2c. Forms for farmer participatory evaluation of leaf culinary quality

FORM 5C. SWEETPOTATO FARMER PARTICIPATORY LEAF EVALUATION

SITE: _____ Year: _____ Season: _____ PAGE _____

TOTAL NUMBER OF FARMERS _____ TOTAL NUMBER OF FEMALE FARMERS _____ TOTAL NUMBER OFMALE FARMERS: _____

		PREHARVEST ASSESSMENT OF APPEARANCE			ASSESSMENT OF COOKED APPEARANCE			ASSESSMENT OF COOKED TASTE			ASSESSMENT OF COOKED TENDERNESS			OVERALL ACCEPTABILITY		
GENOTYPE CODE	GENDER	# RED	# YELLOW	# GREEN	# RED	# YELLOW	# GREEN	# RED	# YELLOW	# GREEN	# RED	# YELLOW	# GREEN	# RED	# YELLOW	# GREEN
	1 - MALE															
	2 - FEMALE															
	1 - MALE															
	2 - FEMALE															
	1 - MALE															
	2 - FEMALE															
	1 - MALE															
	2 - FEMALE															
	1 - MALE															
	2 - FEMALE															
	1 - MALE															
	2 - FEMALE															

Group ranking of varieties for the overall culinary quality/acceptability of sweetpotato greens using pair wise comparison

	Variety				
Variety	A	B	C	D	E
A	X				
B		X			
C			X		
D				X	
E					X
Total frequency per variety					
Rank					

Reasons for high ranked varieties:

_____

_____

_____

_____

Reasons for least ranked varieties:

_____

_____

_____

_____