SWEET POTATO SEED SYSTEMS

TRAINING MANUAL FOR FARMERS

SASHA PROJECT,WESTERN KENYA

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ACKNOWLEDGEMENT

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1.0 PART ONE: INTRODUCTION

The manual was developed by putting together a comprehensive reference technical tool for training trainers of trainers (TOTS), trainers and trainees. Although a lot of technical relative information has been published, there was need to filter out for applicability to western Kenya. The information provided in this publication will be essential for enabling the trainers' expertise and extensionist-promoter and promoter-farmer during their trainings.

However, the manual contains a brief account on sweet potato importance both as a food and nutritional security crop. The contributions from different stakeholders including the end-users provided relevant and feasible ideas which will contribute to improvement of entire sweet potato production process.

1.2 Objectives of the Sweet potato Production Trainers' Manual

This proof-of-concept project proposes an integrated agriculture, nutrition, and health intervention to maximize the nutritional benefits of introducing orange-fleshed sweet potato (OFSP) into communities affected by HIV/AIDS in the Western Province of Kenya.

The driving goal of the SASHA Ag-Health Project for Western Kenya is to improve the health status of pregnant women and the nutritional status of children up to two years through an integrated OFSP and health service delivery strategy through an existing health program (APHIA II) in Bungoma and Busia districts of Western Kenya.

The goal of this training manual that focuses on seed systems is therefore to enhance knowledge and skills among field extension staff and farmers involved in vine multiplication and production to be able to produce in a sustainable way, clean and healthy vines. This will lead to increased production and productivity of OFSP, consumption of tubers and increased returns from the sweet potato enterprise.

The training manual has been designed specifically for training farmer trainers and subsequently farmers promoting and/or participating in improved sweet potato vine multiplication and conservation. As a simple, applicable and relevant technology pack, the information composition therein considered the recommended against the existing practices. For example, in Bungoma, using vine cuttings seeds is not a new phenomenon to the farmers because they have been depending on

vines from the previous season. Most of these vines are of age and infected and infested by diseases and pests respectively. Thus, the critical issue is how farmers can improve on their choice of seed sources. In a participatory manner the trainees should recognize and appreciate that there is need to adopt the introduced skills and technologies to perfect their own. In some instances farmers will need to be convinced to drop their practices such as collecting vines that show symptoms of sweet potato viral infections because they are normally ignorant about the diseases and the mechanisms through which the disease is spread and end up sourcing infected vines especially when the choice is limited. The trainers will have appropriate comparative samples of what is a clean and un-clean planting material during the training, as well as visiting OFSP fields where symptoms of infection can be seen. The trainees will be equipped with technical skills on sweet potato clean vine multiplication methods. They will also be finally sensitized on sustainable vine supply seed systems among farmer groups which should be strengthened amongst them.

1.3 Scope of training content

The curriculum and learning activities follow the phenology of the crop using simple tools that can be used by the trainees. The layout of the guide starts by highlighting the importance of sweet potato in Africa with particular reference to Kenya and specifically Western Province as the leading province in sweet potato production. This gives a special consideration for beneficiaries to feel that they are dealing with a crop that is not minor as thought but has a recognized position in the farming systems besides being their own.

The manual is in four parts with twenty four sessions in total. Part one is an introduction to the SASHA project objectives, the goal of the manual and scope of the training content. Part two generally delves into sweet potato production right from importance, pre-planting, planting and after planting activities, pest and disease identification, management and control. Part three specializes on vine multiplication and all the related details being a core need for this project. Finally part four is basically additional for trainers particularly for M&E, field visit preparation and generally improving facilitation skills.

Session One

1.4 Session curtain raiser

Knowing each other and subject orientation
Objective*: The objective is to create an interactive learning environment and understand the learning objectives.

Method: Self introductions (names, district, division, location). Participants are informed to ensure they fill the attendance list being circulated round, in the course of the day. Each participant is then provided with a piece of paper or card to write down their individual expectations of the meeting.

These are then collected and displayed by the facilitator. Then a participant is asked to read them, as the facilitator collates them and groups them according to the examples below.

Exercise 1: Sample 1: What is your expectation during this workshop?

Table 1: Summary of the participants' expectations

No.	Expectation	Frequency	Comment by facilitator
1			
2			
3			
4			
5			

Example 2:   Farmers will be asked to write down anything they would like to share, ask or warn other participants about sweet potato production in their area/farm.

No.	Expectation	Frequency	Comment by facilitator
1			
2			
3			
4			
5			

2.0 PART TWO: SWEET POTATO PRODUCTION

Session two

2.1 Back ground and Importance of Sweet potato

Objective: The objective of this session is to enable the participants recognize the important role sweet potato plays worldwide and in individual households as a food and cash crop.

Method: The participants should be allowed to give their views on how they use the sweet potato before the intervention of the trainer.

Sweet potato is globally the second most economically important root crop after potato and is an important food security crop in many of the poorest regions of the world including sub-Saharan Africa. Root crops are unusually important relative to cereals in Africa
In East Africa, sweet potato is grown predominantly by women, for both home consumption and to supplement household income by sale to local markets and urban centers.
In Kenya, sweet potato plays an important role in food security
African farmers produce sweet potato mostly for human consumption. African yields are quite low about a third of Asian yields because of differences in crop management indicating huge potential for future growth.

Historical importance: Disaster lifesaver: The Japanese used it when typhoons demolished their rice fields, it kept millions from starvation in famine-plagued China in the early 1960s, and in Uganda, where a virus ravaged cassava crops in the 1990s, rural communities depended on the sweet potato to keep hunger at bay.

Nutrition: – Sweet potato is high in carbohydrates and vitamin A (OFSP) and can produce more edible energy per hectare per day than wheat, rice or cassava. The OFSP were specifically bred for their Vitamin A value.
Other advantages of OFSP include; - high yield, resistance to some pests and early maturing (3-4 months). Sweet potato has an abundance of uses ranging from consumption of fresh roots or leaves to processing into animal feed, starch, flour, candy, and alcohol. Sweet potato flour can be mixed with flour from other crops to make mandazi, chapati, cakes, doughnuts, biscuits, etc. Sweet potato roots can be boiled alone or mixed with other foods such as beans, bananas, vegetables, peas for consumption.
The crop can be grown in poor soils with little fertilizer and its hardy nature and drought tolerance make it adaptable in broad environments.

Session three

2.2 Experience in Sweet potato production

Objective: To let participants share their experiences in sweet potato growing
Method: Discussion topic: Participants to give their experiences in growing sweet potato. (land preparation, establishment, varieties, pests and disease management, harvesting method, utilization of vines and tubers, preservation of vines during dry season, storage of vines and tubers). The trainees are also expected to highlight challenges experienced which are then ranked in the table below. In discussion with the facilitator, they then provide potential solutions for those challenges.

Table2: Summary of understanding the challenges in sweet potato from farmers' experience?

No.	Challenge	Rank	Potential Solution	Rank
1				
2				
3				
4				
5				

The trainer should summarize the discussion to put the participants in a situation to recognize that the challenges are real, theirs and need to be addressed.

Session four

2.3 Development of area specific sweet potato annual calendar

Session objective: Participants to generate an annual sequence of farm activities as a basic guide for planning activity schedule for sweet potato. It should help to answer the question as to "when" different activities should be done and provide the clue for implementing the various intervention activities.
Method: Participants to be divided into sub-groups to develop the sweet potato calendar by filling in the table below and a common activity scheme will be drawn during the plenary session. This information will provide a guide for designing this season's activities.
Exercise 2: Development of sweet potato activity annual production calendar

Table 3: Sweet potato calendar

Month	Dry (D)	Wet (W)	Activity	Remarks
January				
February				
March				
April				
May				
June				
July				
August				
September				
October				
November				
December				

Exercise 3: Sub -group assignment to develop annual sweet potato activity calendar for presentation during plenary session.

Session five

2.4 Sweet potato pre-planting activities

Objective: The aim is to enable the participants appreciate the importance of timely field preparations, planting and factors affecting vine quality.

Method: through lectures and participatory discussions, participants will be taken through sweet potato pre-planting activities

2.4.1 Selection and preparation of sites
* Fields should be located at least 100m away from previous sweet potato fields to avoid spread of pests and diseases. If land is limited and farmers cannot avoid planting next to old sweet potato fields, then they should ensure the old sweet potato fields are completely cleared of old storage roots and vines and these are then burned or fed to livestock well in advance before preparing new area for rapid multiplication.
* Sweet potato requires well drained, easy to work soils. The crop can be grown in any soil, but sandy loams give the best yields. Avoid growing the crop in stony soils or water-logged areas such as clay soils.
* Be near a water source that does not receive
* In a proper crop rotation, sweet potato can follow either cereals such as maize, sorghum, rice, finger millet, or legumes such as beans, cow peas, soybeans and sesame (simsim). Sweet potato should never follow root (cassava, yams) or tuber (Solanum potato) crops, because these have almost similar nutrient requirements.

- Land preparation is done using either a hand-hoe or plough. It aims at turning over the topsoil and, in the process, plant residues are incorporated into the soil. Prepare the field well in advance (at least two weeks) before planting sweet potato, to allow enough time for plant residues to decompose (rot) and release nutrients (food for crops).
- Use mounds or ridges for planting as these methods ensure good drainage, and make it easier to harvest the mature roots, especially if harvesting is done piecemeal, and kills weeds by burying them.
- Deep cultivation improves the oxygen supply in the soil, which favors the growth of bacteria that help in decomposing the organic matter. Also, ensures that annual weeds are buried so that they do not compete with the young sweet potato planting material. In addition, the compacted parts that have been trampled by humans, animals and tractors become loose again, thus increasing aeration and water infiltration and good drainage. Furthermore, deep cultivation is essential for good storage root growth and expansion in order to realize higher yields.
- Dig diversion water ways and plough along the contours to minimize on soil water wash.
- Monitor the weather to plant timely when rains are highly predictable to avoid loss of planted vines through desiccation, avoid late planting season planting because it results into reduced root yield.
- Divide the field into portions based on the quantities for the different varieties and plant single variety plots

Plant vines on mounds or ridges (on sloppy land).

2.4.2 Sourcing and selection of vines

- Select your planting material from a clean, healthy, vigorous looking crop, which should be 2 or 3 months old. Vine cuttings from such a crop produce a vigorous crop and better yield, whereas vines cut from an old crop (4 to 6 months) produce a less vigorous crop and poor yield. This is because as the crop approaches maturity, food stored in stems (vines) is channeled to the enlarging storage roots.
- The best planting material is the stem (vine) tip - the top- 30 cm of the vine, when planting material is abundant, and it should include at least 3 nodes. This part most easily recovers from cutting and planting "shock", and it grows faster than the lower parts of the vine. In addition, the tip is more likely to be free of sweet potato weevil and stem borer eggs. The middle parts of the vine may also be used if there is a shortage of planting material. Avoid, as much as possible, the basal (lower) parts of the vine as these may have eggs, larvae or adult weevils inside.
- The cut should be clean and slanted so that water can slide off and not sit on the wound.
- Principally before picking the vines verify the source or confirm that the vines selected are healthy by visually ensuring those vines are free from both pests and diseases infestation by checking for obvious symptoms including eggs, larvae and even adult pests, dark spots on the foliage, folded, curled or shriveled leaves
- Dis-infestation is done by dipping vines in a mix of ½ cup ash in 5 liters of water for 5 minutes on the planting day just before planting.
- Fresh and of desired vine length (20 – 30cm).
- It is important also to check the field suitably and readily prepared before cutting the vines to ensure planting within 2– 3 days after cutting to avoid deterioration.

2.4.3 Vine storage

Planting of sweet potato vine cuttings is preferably done as soon as possible, after they are selected and cut. However, this may not always be possible, for instance, when it is too hot, when the field is not ready yet, labor for planting may be scarce, or due to any other reasons. Cuttings can be kept for a maximum of seven days, before losing condition that leads to large reduction in storage root yield. Storing vine cuttings for 1 - 3 days does not affect the final yield. In order to preserve the food reserves in the stem, most of the leaves on the cuttings should be removed, leaving only a few leaves at the tip. Then the cuttings are tied in small bundles with their bases covered with a wet cloth or sack. The bundles are kept in a cool and shady place.

Alternatively, may be partially buried in a narrow trench under the shed of a tree with the vines spread out along the trench, with two-thirds of the vines under the soil surface.

During the storage period, roots may develop at the base of the cuttings. This is called "pre-sprouting." The cuttings should then be carefully planted with the roots. Storing the vine cuttings hardens them, that is, they become tougher and more resistant to the "shock" of planting. Establishment is faster when vine cuttings are pre-sprouted. However, there is no yield advantage from this practice.

How do the vines harvested for transportation to distant areas handled and stored? And what period is appropriate between harvesting and final delivery?
(Participants will practice cutting vines for planting during field visit on the last day of the training)
May be cutting could be combined with preserving vines in trenches or moist soils practices)

Session six

Objective: Participants to conceptualize the importance of recommended planting techniques as compared to the existing practices.
Method: Lectures and participatory discussions including demonstrations will be necessary.

2.5.1 Methods of planting

Sweet potato is grown on mounds and ridges of varying sizes, but rarely on the flat. The mound type of seedbed is the most common, whereas ridges are used in hilly or sloping areas to control soil erosion. Plant spacing for vine multiplication should be closer than for root production. Spacing for vine multiplication on ridges should be 20cm x 20cm between plants. A mound should be 100 cm (3 ft) wide and 60 cm (2 ft) high. The distance between mounds should be 1 m (3 ft).   Ridges should also be 100 cm (3ft) apart and 60 cm (2ft) wide. Although the difference in yield between ridge and mound seedbed is small, research has been demonstrated that ridges give much higher income than mounds, simply because making ridges requires less labor. Ploughing using oxen or tractor is also possible when ridges are chosen. However, mounds are better in flat areas that are infested with mole root rats.

Avoid planting late in the growing season as this exposes the crop to drought and weevil damage. Weevil damage reduces both yield and quality of storage roots especially during dry spells. Planting on mounds is the commonest method used by most farmers in Kenya as. Other methods include planting on ridges and flat land.

2.5.2 Placement of vines in the soil

The planting operation involves pushing the lower parts of the vine cuttings into the soil, such that they are nearly horizontal. About 20-cm (8 inches) length or two thirds of the cutting should lie beneath the soil surface.

2.5.3 Spacing and Plant population

When mounds are used, three vine cuttings are planted singly in a triangular pattern below the tip of each mound, giving a plant population of about 33,300 plants per ha (or 13,500 plants per acre). If planting is on ridges, single vine cuttings spaced 30 cm (1 ft) apart, are planted in one row along the ridge top, giving the same plant population as mounds.

Exercise 5: Field demonstration on methods of planting and vine placement

Each variety should be planted as a single stand even if on the same field for easy management including weeding. The sub-plots should be separated by 1-meter alleys/walkways as in the table below, and after planting each variety/sub-plot should be labeled with date of planting and name of variety indicated.

Table 4: Field planting plan

	KABODE	
	VITA	

Plant single vine at the spacing of 30 cm between plants on the ridge of 1m wide
(A demonstration on planting on ridges and even mounds may be necessary)

Session seven

2.6 After planting field activities

Objective: Participants to appreciate the importance of carrying out different agronomic practices timely and relating the observed practices to crop performance.
Method: Lectures and participatory discussions including demonstrations will be necessary.

2.6.1. Rouging and gap filling

Do rouging and gap filling where necessary. Rouging is the removal of plants that have disease especially Sweet potato Virus Disease (SPVD) symptoms and gap filling is re-planting in spots where the planted vines have died with the first 2 weeks after planting.

2.6.2 Weeding

Ensure that weeds (including their root systems) are removed or buried deeply during land preparation. Weeds are unwanted plants that compete with the crop for nutrients, light, water and growing space, and provide refuge for insect pests. Selectively eliminate the unwanted plants and those that are useful can be cut back if they are too vigorous including those that easily die can be left in the field as mulch or used as fodder. Weeding should be accomplished before the sweet potato vines cover the soil.

Hand weeding is done two times - the first round at 3 weeks after planting, and the second one at 6 weeks after planting, are enough when the seedbed has been well prepared. Late weeding encourages serious competition between crop and weeds for sunlight, nutrients and water; this leads to low yield.

Herbicides such as Round up (glyphosphate) can provide easy and effective control of most of the problem weeds encountered in sweet potato fields. A good practice is to dig planting ridges or mounds 2 – 3 weeks prior to planting then spray the any weeds that emerged are sprayed before planting. The vines of sweet potato grow slowly at first and it is essential to make sure the land is weed free until the crop is well established and growing strongly.

Session eight

2.7 Pest and disease control

Objective:-To introduce to the trainees the various key pests and diseases that cause economic loss to sweet potato enterprise.

Method: The session will involve going through these in terms of description of the pest or disease, its mode of destruction and the available control measures.

Facilitator should have materials infected and infested by diseases and pests (respectively) where possible. Emphasis should be made on seasonality and trends of pest infestation and disease infection.

Infestation by pest is a major limiting factor in successful production of sweet potato (Talekar, 1988), and integrated crop management techniques were not only effective but also economical in disease control (Namanda et al., 2003).

2.7.1 Meaning of Integrated pest and disease management

The concept of Integrated Pest Management (IPM) refers to application of a combination of control approaches used to reduce pest or disease damage to tolerable levels and not aiming at complete elimination. The techniques include use of cultural farm practices such proper agronomic practices, planting tolerant varieties, environmental modifications and appropriate or minimal chemical pesticides. The choice of set of control components depends on the key pest or disease to control, part of the plant attacked, the kind of loss caused, and control measures available.

Session nine
2.7.2 Description and management of major sweet potato pests in Western Kenya

2.7.2.1 Sweet potato weevils (SPW)

Photo 1 .Potato weevil adult & larvae stages
Development cycle:
Adult lays eggs at the base of the plant which hatch into larvae within 3 – 7 days
Larvae pupate in the tunnels within 11- 33 days.
Adults emerge within 3 – 28 days.

On average egg – adult development takes 32 days.

Description:
Larvae (most destructive stage) are white, legless, curved, and delicate and stay within the roots
The small and brownish or black and large SPW are more common than bluish black abdomen and reddish brown thorax

Mode of destruction

Larvae tunnel in the vines and storage roots causing significant damage by depositing frass resulting in roots producing toxic substances that render them inedible.
Larvae also feed inside the vines causing malformation, thickening and cracking of affected vines.
Adults feed on the vines and stems, and external surface of storage roots causing feeding punctures.

Control measures
Carry out cultivation practices aimed at preventing infestation. Early planting and harvesting to avoid the dry period, Use insect free planting materials, plant away from weevil-infested fields, piecemeal harvesting to remove the largest storage roots most at risk from weevil attack and subsequently hilling up the soil around the remaining roots to prevent sweet potato weevil from being able to access the roots through cracks in the soil, and re-ridging 30 days after planting.

2.7.2.2 Clearwing moth

Development cycle:
Adult moth lays butches of yellowish eggs on vines and leaf stalks which hatch into larvae after a few days.
Larvae bore into the vines and tunnel downwards towards the vine base where pupation takes place just above the ground level.
Description:
Larvae can reach 2.5 cm long, whitish, with hyaline patch at back with brown head capsule.
Wings spread outwards at acute angle to bodyline posing like a wasp.
Mode of destruction

Larvae burrow at hard part of stem base causing swelling at soil level and easily break off.
Larvae can tunnel through the vine into the storage root (usually only the root tip is affected).
Feed on the of vines and stems, and external surface of storage roots causing feeding punctures
Vine swell at soil level and easily break off.
Management

It is not often necessary to control this pest. Cultural methods similar to those used against the sweet potato weevil should be effective in reducing the incidence of this pest, e.g. use of clean planting material, hilling up of earth around base of plant, sanitation and timely harvesting.

Aim at reducing/ avoiding infestation by:-

- Avoiding planting infested vines, usually avoid cuttings from the base part of the stem
- Alternate host plants
- Crop rotation

- Removal of volunteer plants
- Timely planting and prompt harvesting to avoid a dry period
- Planting a way from weevil infested fields
- Hilling up of soil around the base of plants and filling in of soil cracks and ensure that roots are not exposed on the surface
- Destroy infested plant parts (roots, stem bases)
- Removal of vines and storage roots from the field after harvesting to avoid build up especially during dry season
- Flood (irrigate) the field for 24 hours after completing harvest
- Treat the vines with insecticide such as carbofuran or diazinon for 30 minutes prior to planting to minimize on initial infestation in the field.
- Hand picking and destruction of bugs.

2.7.2.3 Sweet potato butterfly
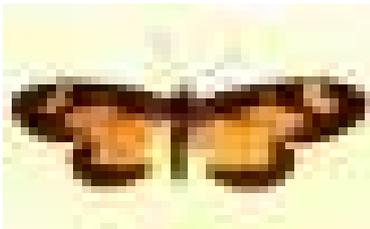
Photo 2: Adult butterfly and caterpillar

Development cycle:
Pale yellow eggs are laid in batches on both surfaces of the leaves which hatch into greenish black larvae (caterpillars) covered with branching spines
Life cycle takes 27 – 50 days
Description:
Larvae are concentrated in protective webbing during the first 2 weeks after hatching which then become solitary and hide from the sunlight on the ground during the day
Pupae are yellowish and hang singly on the underside of leaves or on another support
Adult has orange wings with brown markings at wing margins and are strong fliers

Mode of destruction
Caterpillars feed on leaves – young caterpillars feed on the upper surface, whereas older ones eat on the whole leaf except for the primary midribs. Complete defoliation may result from severe attacks.
Outbreaks are sporadic and seasonal and usually occur at the beginning of the dry season

Control
Monitor for possible outbreak of sweet potato butterfly adults and damage early in the dry season.
Clean un-infested planting material should always be used
Webs containing young caterpillars should be collected and destroyed weekly.

Early planting and harvesting enables the crop to escape severe attacks
Chemicals such as carbaryl, pyrethrum can be used.

2.7.2.4 Rodents: Root rats, field rats and squirrels

Control of root rats: Do not plant sweet potato on ridges; plant Tephrosia herbs around field; trapping with 'Mutoto' traps
Field rats controlled by: weeding garden clean; harvesting when crop is ready; use break-back traps; deploy biological control agents, e.g. cats. Snakes hunt down the rats and destroy nesting sites

Rats and mole/ root rats (efukho) occasionally feed on sweet potato storage roots either by digging through the ridges and mounds or accessing the exposed roots. They often spoil more roots than they actually eat. Signs of their damage and presence include: small mounds of freshly dug soil, sweet potato vines being pulled back down into the soil, holes in the sides of ridges or mounds

Rodent damage can be reduced by:-
- Destroying rodent burrows.
- Keeping the field and surrounding areas clean of vegetation and rubbish to help reduce rodent populations.
- Digging a deep ditch around the perimeter of their field to prevent rodents from digging tunnels straight into the fields.
- Use of mounds in establishment
- Poisoning using pesticides, e.g. Fuko-kill (phosphine can be combined with chemical pesticides)
- Use of repellent materials inside their unblocked burrows – some traditional control practices include
- Spreading the leaves of repellent plants
- Placing a mixture of cow dung and pepper in the burrows and burning it to smoke the rodents out, or pumping the smoke into the tunnel to try and suffocate it.
- Planting the deep-rooted, poisonous shrub Tephrosia vogelii in the field to repel mole rats.
- placing human faeces in the rodents burrow
- Drowning the rodent by pouring water into the hole/ burrow, mixtures of hot water and pounded hot chili pepper are reported to kill them.
- Traps can be set in locations where livestock and children will not interfere or get hurt by them. The Mutoto mole rat trap design that is popular in W. Kenya is shown in the diagram.
- Poisoning. Since rodents are mammals, any poisons that kill them will seriously harm humans and livestock so poisoning is not recommended unless closely supervised, as baits may be eaten by livestock or children. Use of Phosphine tablets in tunnels is effective.

NB: Rodent control works best if done on a large scale, so it is worth trying to interest one's neighbors.

2.7.2.5 Millipedes

Photo 3: Millipede

- Infestation tends to be severe at the beginning of the season and common in areas with low soil fertility.
- Different species attack sweet potato
- Other crops attacked are Solanum potato, ground nuts, maize, beans
- Do not plant sweet potato following groundnuts
- Cultural management practices: crop rotation, destruction of nesting sites
- Do not plant sweet potato following groundnuts

2.7.2.6 Vermin e.g. Monkeys and wild pigs:
- Plant away from forested areas
- Controlled hunting and planting fields in blocks.
- Capture one monkey, paint him red and let go.
- A bell can also be hung on neck of a monkey.

NB: Vermin should not be poisoned

d) **Domestic animals**: Control by using the law, planting crops in blocks, spraying cow dung or urine on foliage, fencing the field with barbed wire, net wire or live fence. Tether domestic animals.

e) Guinea fowls often destroy sweet potato roots- but damage do not warrant control

Session ten
2.7.3 Description and management of major diseases
Objective: To let participants understand common diseases of sweet potato and means of control and management.
Method: Description by facilitator, samples of diseases, diseased plant photographs and field visits are combined.
Where do diseases come from?
Plant diseases may be caused by Nematodes, Fungi, Bacteria and Viruses.

Diseases come from diseased plants or their remains and they are spread by wind, insects, or some other means, or from a previous cropping cycle in the same field. Most sweet potato diseases are spread from previous or nearby older crops of sweet potato. Sweet potato viruses are destroyed when an infected plant dies. The viruses are commonly spread during the process of harvesting vines for planting. However, many fungal and bacterial diseases can survive on plant debris or in the soil for long periods of time until new host plants become available.

Therefore to minimize disease incidence, ensure that clean, healthy disease-free planting materials are used, in a new field where there has not been sweet potato in the previous season, and which is away from other sweet potato.

2.7.3.1 Alternaria leaf spot

Symptoms

Photo 4: Alternaria symptoms

First small, brown/grey/black oval lesions with typical bulls' eye appearance of concentric rings, on leaves, stems and petioles.
 On the lower side of the leaf, blackened veins are observed. Subsequently the lesions widen and surrounded by a yellow halo.
Cause and Spread
- Caused by a fungal pathogen
- Through soil, plant debris, infected plant material, splashing rain and water.
- Increased humidity, wet and high altitude conditions lead to high level of disease incidence and lesion size.
- It is the most damaging fungal disease affecting sweet potato foliage in Africa
Management
- Destroy and burn infected crop material
- Use clean planting material
- Crop rotation
- Use of tolerant varieties
- Fungal sprays could be used for commercial production of vines

2.7.3.2 Sweet potato virus Disease (SPVD)

Photo 5: Sweet potato virus disease

Symptoms
- Purplish spots, mild vein clearing, or small yellow chlorotic spots.
- Usually more pronounced under conditions of environmental stress and will always show first on older leaves.

Cause, spread and impact
- Belongs to the potyvirus group of plant viruses.
- It is easily spread by planting infected cuttings or roots, and by aphids including the cotton aphid (Aphis gossypii) and the green peach aphid (Myzus persicae).
- Severe impact on the marketability of roots can be up to 20 percent lower than from healthy plants.

Management
- Replacement of plant
- Field surveillances and roguing out infected plants
- Use clean planting materials
- Isolation vine beds and banks from old fields
- Rotations

Session eleven

2.8 Maturity period and harvesting

Objective: To enable trainees appreciate the different factors that determine harvesting and the effect of delayed harvesting on pest and disease build up as well as ways of assessing root yield in their farms.

Method: Lectures and participatory discussions seeking particularly the participants' experiences.

Factors considered in determining the time of harvest are:-
- Variety's growth duration and its capacity to be prolonged
- Environmental Conditions (water supply, soil condition, weather, etc)
- Pest and disease incidence
- Market demand

- Market price
- Need of land to plant the consecutive crop
- Economic value of the consecutive crop

Sweet potato roots are ready for harvesting between 3 – 8 months after planting. Varieties such as Ejumula, Kabode, Kakamega and Vita mature within 3-5 months after planting. If the crop is harvested too early the roots will not be maximally developed or too late the roots may be fibrous and possibly pest infested thus reducing yields.

Piece meal harvesting involves the farmer moving around the field looking for cracks on the mounds and ridges, which they perceive as being indicative of a sizeable root, and then removing selectively larger roots after which the earth is heaped up over the remaining smaller ones to allow continued bulking. The practice involves harvesting small quantities and normally starts as early as 2 months after planting for some varieties. Varieties with longer maturity period are usually more suitable for piecemeal method than early maturing ones which have all their storage roots maturing at almost the same time. Harvest duration is a function of factors including variety, soil type, availability of other foods, household size, disease and pest infestation, and weather conditions.
Complete harvesting involves whole removal of the plants irrespective of whether all the roots are mature or not and is mainly for commercial sweet potato growing.

2. 8.1:   *Assessment of Root yield*

Estimation of root yield under the piece meal type of harvesting is normally difficult and even under whole harvesting farmers can only quickly recall the number of bags of marketable roots filled but not quantity of smaller roots that could not be sold. On average a bag of marketable roots ranges from 150 – 180 kg (CIP) The number of plants in the selected sample unit are counted and recorded, and the quantity of storage roots in the field can be easily accessed by estimating the yield of three representative sample units of 2 meter squared each. The harvested sample roots are counted and weighed then an average of all the samples is extrapolated into either acre or hectare standard units of area.

Table 5: Harvest data record sheet

Name of variety	Mounds harvested	Plants harvested	Number of roots		Weight of roots	
			Marketable roots	Unmarketable roots	Marketable roots	Unmarketable roots

Discussion questions with participants
- *What are the reasons for best yields?*
- *What could be the reasons for worst yields?*
- *What could be the reasons for unmarketable roots?*

3.0 PART THREE: VINE MULTIPLICATION

Session twelve

3.1 Seed vine multiplication methods:

Objective:-To enable participants appreciate the different methods of vine multiplication including advantages and disadvantages of each method.

Method: The trainer should elaborate on the method recommending when and where to use each method .The method will involve lectures and demonstrations.

Two methods in practice:-
1. Rapid multiplication
2. Conventional (mounds, ridges and flat land)

Ridges of 1m apart are prepared for establishment especially on hilly areas. This helps in controlling soil erosion and moisture conservation during water scarcity. Mounds of 1m wide and 60cm height are prepared which gives an appropriate plant population required in one acre.

3.2 Vine characteristics and sources in Kenya

Table 6 shows the characteristics affecting sweet potato vine production, advantages and disadvantages of the common sources of vines in Kenya.

Table 6: General characteristics of sweet potato vines

Character	Importance	Recommendation
Bulky and highly perishable	Not easy to transport large quantities	Requires open transport trucks and delivery made within 24 hours after packing
Vegetative propagated	Slow multiplication rates and easy transmission of pests and diseases	Need technologies that will improve on the rate of multiplication and management techniques

		to minimize disease and pest infestations
Vegetation withers/dries during prolonged drought	Loss of planting material (vines)	Adopt conservation technologies
Plant part sources	Roots and growing plants	Both are potential sources of vine production

Session thirteen

3.3 Qualifications of a seed grower

Objective: To enable participants understand the requirements for one to qualify for vine production enterprise.

Method: Lecture and participatory discussions

The planting material of sweet potato is a "vine" (shoot cutting) that grows from and is a clone of the mother plant. Note that seed vine is different from vine seed in that seed vine refers to vines originating from known seed producers and informally certified as free from pest and disease infestations; true to type; and known field source; "healthy vines", and vine seed is planting material from any sources other than seed-growers multiplication fields.
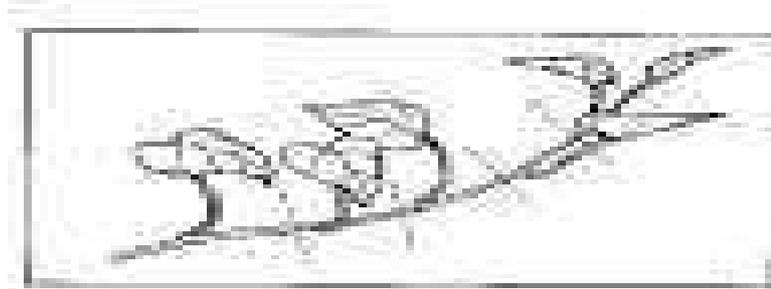
Photo 6: Recommended vine cutting

The pre-requisites for an entrepreneurial vine grower include:-
- Access to land that is in close proximity to reliable source of water for periodic irrigation (avoid water sources that are fed by drainage and alleys between beds)
- Soils should be fertile and well drained, and field adequately isolated from previous or old fields
- Have basic practical knowledge and skills on production of high quality planting.
- Should have the interest in the enterprise.

3.3.1 Categories of vine Multipliers & qualifications

Primary vine multiplier
- Knowledgeable at tertiary level of education

- Practical experience of production of high quality sweet potato vines
- Knowledge of several varieties and their characteristics
- Must have working relationships with research institutions, NG'Os and other government agencies.
- Have a permanent water source for irrigation(avoid run-off from other fields)
- Accessible to the public but with restrictions
- Have fertile, loamy and well drained soils that are secure from intrusion from animals.

Secondary vine multiplier
- Must show interest in the enterprise
- Must have experience in growing sweet potato already
- Have a permanent water source for irrigation in times of drought(avoid run-off from other fields)
- Accessible to the public
- Ability to read and write ,therefore keep records
- Have fertile, loamy and well drained soils that are secure from intrusion from animals.

Tertiary vine multipliers
- Interest in the enterprise
- Permanent water source
- Good soils
- Ready to learn

These categories should be well described to participants.

Session fourteen

3.4 Vine multiplication process

Objective: To enable trainees appreciate the various techniques of vine production and the need for rapid multiplication

Method:-Facilitator should explain to participants about rapid multiplication techniques and its advantages in   primary seed vine multiplication.

Steps in preparation of mounds, ridges and flat land for vine multiplication should be explained. Plenary discussions and subgroup discussions after field visit will be done

3.4.1 Preparation for planting
Table 7: Activities during preparation for planting

Practices	Recommendation	Importance
Site selection	The site should be fertile, easy to work well drained soils and near a water source that is not fed by drainage and water alleys or run-offs from old or previous fields. Beds should isolate by at least 100m from old and previous sweet potato fields' and areas	Minimize pest and disease transmission, easy irrigation and facilitates good initial plant establishment

		suspected to harbor pests and diseases transmissions	
Land preparation (1st&2nd)	Ample time at least 2 weeks to planting. First and second preparations are at two weeks interval.	Facilitate organic decomposition	
Nursery bed Preparation	Loosen the soil, mix with compost manure, prepare to moderate soil tilth	Fast establishment and growth	
Bed preparation	Moderate soil tilth and oriented across the field slope. Prepare raised nursery beds 1 - 2 m wide, 20 cm high and the length will depend on material availability. Planting media should be made with a mixture of loose, humus-rich soil, organic compost and kitchen or rice hull ash. If available, apply well decomposed farmyard manure at a rate of one wheelbarrow per m^2, or NPK (17 - 17 - 17) at the rate of 25g per m2 (if available) and insecticide (carbofuran) at the rate of 5g/m2 (if available) - mix these thoroughly with soil before planting.	Enable easy establishment of planted cuttings and minimize on soil water wash	
Seed selection	Vines should be obtained from healthy and vigorous growing plants. Healthy storage roots are selected from plants that produced a high yield, and planted in seedbed away from other sweet potato crop. The vines selected for harvesting should be true to type, free from pests and diseases infections and about 2 months old crop.	Minimize the disease transmission and facilitate easy establishment	
Cutting vine	Top 25-35 cm portion. Vines selected from a crop that is 2-3 months old are more vigorous than those from 4-5 months old. The food reserves from the stems and leaves of older plants are transferred to the rapidly expanding storage root. Cut in slanting manner using a sterilized knife.	Recovers quickly from cutting shock and more like to be free from pests and diseases	
Watering	Soften the soil	Avoid injuring vines through bruising	
Fencing	Construct barriers to ward off livestock and un-invited visitors	Avoid destruction	
Bed size and layout	Narrow beds of 1-2 m wide and provide additional space for driveways and alleys between beds	Facilitate easy planting, weeding, fertilizer application, harvesting practices without workers damaging the plants	

Exercise 6: Participatory sub group sessions/presentations and plenary discussions on vine selection and bed preparations.

Participants will visit a nearby field to pick samples of healthy and unhealthy vines and roots and each sub-group will note the reasons for each category on the charts for presentation during the plenary.

Exercise 7: Assess the potential of a selected sample site for vine production
The facilitator will choose a sample site and each sub-group will take notes on its capability or incapability to be used for vine production. These will be presented during the plenary for participatory discussion and make joint recommendations for possible improvement or rejection.

3.4.2 Planting practices

Preparation and planting of vines
- Plant spacing for vine production should be closer than for root production (For high vine production per unit area).
- Spacing for multiplication (between plants) should be 20 cm x 20 cm or 20 cm x 10 cm depending on availability of planting material. Each 30 cm cutting may be cut into pieces each of which must have at least three nodes.
- One kilogram of sweet potato vines provides 100-120 cuttings each 15 cm long, this is enough for a one square meter nursery bed when using 10 cm x 20 cm spacing.
- Before planting, dip the cuttings in a solution of the insecticide carbofuran (0.05%) for 20 minutes, if an insecticide is not available, dip the vines in a solution of water and ash (one-half cup ash in 5 liters of water) for 5 minutes to kill those diseases and pests that cannot be seen with the naked eye.
- Two-thirds of the cutting (two nodes) should be planted beneath the surface of the soil in a slanted position (Minimizes exposure of vines during watering).
- After planting, apply NPK (17-17-17) at the rate of 42 grams per m^2 (Note: the fertilizer rates may need to be adjusted depending on existing levels of soil fertility and local experience).
- More care and attention when watering and during fertilizer application.
- Label the beds noting the date of planting and variety. This allows easy follow ups and subsequent activity scheduling.

Table 8: Ethical planting techniques

Activity	How	Importance
Placement	Plant upright/slanting and at high density	Upright emergence of the shoots
Spacing	High density planting	High vine production per unit area
Depth of planting	Avoid shallow planting	Minimizes exposure of vines during watering
Watering	Light watering prior to planting to minimize on desiccations	Provide conducive establishment conditions
Labeling the beds	Indicate the date of planting, variety	Easy follow ups and subsequent activity scheduling

Session fifteen
3.4.3 After planting agronomic practices

Table 8: Ethical planting techniques continued

Activity	How	Importance
Regular watering	Daily 2-3 times a day during non-rain season and as necessary during the wet seasons	Avoiding bed drying especially during dry seasons, soften the soil for root initiation and maintain adequate soil moisture for plant growth. Irrigation after each cutting helps rejuvenate the beds and activate applied fertilizers.
Gap filling	Should be done as soon as growth failure at buds is noticed	Maintain plant population
Weeding	Hand and light hoeing are used to remove weeds, diseased plants and off types, and cover exposed underground stems with soil	Minimize competition for nutrients, spread of diseases and maintain variety integrity
Pest and disease Management	Rouging, avoid previous sweet potato fields, runoff water, apply pesticide	Produce clean planting material
Fertilizer application	Apply compost manure as a basal fertilizer by incorporating in the beds. Top dress with NPK or Urea(40-0-0)@13 gm/m^2 applied between rows whenever harvesting is done	Encourages vigorous growth and increased lateral emergence
Choice of vines to cut	Positively select vines from vigorous mother plants	Ensure clean starter material and known yield performance
Harvesting / tools to use	Sharp blades to cut at slanting angle	Minimize on pathogen transmission and vine healing

Timely harvesting	Before creeping or touching the soil especially for indeterminate varieties	Minimize water and nutrient waste or translocation to unwanted roots (sinks)
Primary vine harvesting	Harvest top portion and leave the lateral branches on the lower portion to grow. Normally at 40 – 60 DAP(days after planting)	Recovers quickly in subsequent multiplicative beds and laterals to provide vines for secondary harvesting
Auxiliary harvesting	Ratooning is normally done every 2 weeks after first harvesting and should not continue beyond 4 after planting	Multiplier process to generate more vines

Exercise 8: Participate in determining rates of fertilizer application and applicability of positive and negative selections.
Calibrate equipment for fertilizer application.

Session sixteen
3.4.4 Harvesting and handling of vines

Objective:-To let trainees understand techniques of vine harvesting and handling to maintain quality.
Method: The trainer should come up clearly and train the participants the harvesting techniques to avoid destruction of the seed vines. Practical sessions should be held and participants asked to practice.

- After 6-8 weeks (depending on growing conditions) and use of fertilizer, each vine planted for rapid multiplication produces, 15 plants.
- Harvest the top portion (25-35 cm) long and 10cm above the ground and leave lateral branches for the lower portion to grow for subsequent vine production. This helps the plant to recover quickly.
- Use sharp cutting tool that should be sterilized in hot water or burning fire first.
- Two additional cuttings can be made each 6-8 weeks apart.
- Add urea (40.0.0) at 13 g/m2 after each cutting to stimulate re-growth.
- Label the vines after being tied in bundles with their bases covered with a wet cloth/sack
- Find a cool shady place for keeping the harvested vines
- Most of the leaves should be removed, leaving only a few at the tip
- Partially burry in a narrow trench under shade of a tree with the vines spread out along the trench, with 2/3 of each vine under the soil.
- Ensure sufficient moisture throughout the storage period.
- Carefully plant with the roots(Roots develop during storage)
- Careful packaging and transportation is necessary to avoid overheating, vines drying out, and different varieties getting mixed.
- Avoid plastic sacks for better air movement
- Care should be taken not to overfill sacks and over stacking the sacks

Dry season preservation of planting materials

- In areas where there is a prolonged dry season, planting material is usually unavailable at the on-set of the rains. This is because the vines usually die off during the dry season or are eaten by livestock. Farmers then have to wait for vines emerging from left over roots after the on-set of the rains before they can plant. In order to ensure availability of planting materials at the start of the rains, dry season preservation is necessary. This requires an organized selection of planting material during the final harvest.

- Dry season preservation of planting material can be done by planting vines in swampy areas, under shade (trees or bananas) or near homesteads where planting materials can be easily looked after. When planting vines for dry season preservation, ensure proper planting practices, including site selection, clean disease free planting material and nursery management are followed. Protect the vines from damage by livestock and other pests, by fencing or other means.

What would be the recommended characteristics for a site in the swamp?

Exercise 9: Participants to discuss and come up with different ways in which they preserve vines during the dry season and analyze each method, giving advantages and disadvantages for each method.

Session seventeen

> *3.5 Common Challenges in sweet potato vine production*

Objective: To enable participants share their experiences on the common challenges of sweet potato production and possible solutions in their context.

Method: Trainer to share the challenges with the trainees and suggest possible solutions.
- Land tenure
- Gender issues
- Lack of clean materials
- Livestock movement of free range
- Free acquisition of vines (no ownership)
- Seed preservation during dry periods.

Session eighteen

Objective*: -* To enable trainees appreciate the importance of records and have understanding of the common sample records for the enterprise.

Method: Through exercises and illustrations various sample records will be filled by participants using agreed data from their experiences.

Record keeping helps vine multipliers and distributors to know the amount vines produced and distributed per unit area and the income as compared to the costs. Record keeping helps the farmer to do proper planning, minimize costs and maximize income, carry out relevant activities at the right time. Records are also necessary in economic analysis of the enterprise.

Exercise 9: Participants to be led through different types of records related to vine production enterprises.
Table 9: Sample record sheet 1

Farmer Name…………………………………….   Group …………………………

Season …………………………   Year ………………………………….

Plot	Date of planting	Quantity planted	Average cost		

Plot	Date of planting	Quantity harvested	Use		
			Own	**Sold**	**Other s**

Instructions on how to use the table above

The trainer should illustrate the use of the table using hypothetical data. Assume that a farmer had established a bed area of 50 plants and after 60 days 50 cuttings of 30-cm long are harvested (refer to column 2 in the table). The cuttings are further divided into 15 – 20-cm cuttings which are used to establish other beds. Therefore the cumulative number of plants for vine production will be 150 plants (Columns 2 + 3 = column 5) at 2 different growth stages. It is assumed that the stamp will bearing 2-3 laterals which will be subsequently ratooned (note that at 60 days it is only the 50 plants that have been stumped giving about 100 - 150 laterals which will be harvested within a fortnight). Column 6 refers for vines available for field planting to produce roots or vines that would be

supplied by the vine grower. Since the vines generated from the stumping were being re-cycled to produce more vines then at 60 days the farmer is assumed to have no vines for final grower. It is also important to note that life span of the beds should not exceed 4 months after initial planting; therefore, the rounds of cutting will be dictated by the rate at which the growing vines or laterals attain the harvestable length of 30cm above the stump height of 10 – 15 cm. The higher the plant vigor the more umber of cutting rounds.

Table 10: Vine production enterprise record

Date	Activity	Details	Activity cost	Cumulative total cost
	Field preparation			
	Planting			
	Watering			
	Weeding			
	Harvesting			
	Packing			
	Labeling			
	Fencing			
	Fertilizer			
	Spraying			
	Chemical			
	Plant population			
	Monitoring			
	Field hire			

Exercise 10: Participants to confirm include and re-arrange the activity list suggested in the table and using records from their previous activities in vine production complete the table above
Table 11: Vine Sales record

Activity	Plot 1	Plot 2	Plot 3	Plot 4
Mean yield/acre				
Farm price (Ksh.)				
Harvesting cost				
Packing material				
Loading				
Un-loading				
Association fees				
Communication				
Transport				
Packing				

Session exercise 11: Participants to validate the activities in the table and use their experience to complete the details and related costs.

4.0 PART FOUR: SNAP AND SUPPLEMENTARY SESSIONS

Session nineteen

4.1 Introduction to Monitoring and Evaluation

Objective:-To enable participants understand and appreciate monitoring and evaluation and the difference between the two.

Method: Participatory discussions

Monitoring

Monitoring is **continuous assessment** of programme activities to determine whether implementation is as per plan.

It is periodic, for example, weekly field visits should be made to identify implementation constraints and facilitate re-planning.

For example:-

- Is the material clean as defined?
- Are fields prepared on time?
- Is planting on time?
- Is the training applicable or relevant?
- How much quantity of planting material has been delivered?

Evaluation

Evaluation is an **assessment of the programme after a given period of implementation** which can be mid-term. It looks at efficiency and effectiveness and brings out lessons learnt.

For example: -

- What is the performance of the crop after one month?
- Was the training successful attended and completed?

The monitoring tools should be verifiable indicators which determine the progress of the programme activities.

The indicators should be simple, measurable, attainable, and realistic and time bound (SMART).

For example: - number of extensionists trained, number of promoters trained, acreage planted, and yields of sweet potato.

Session twenty

4.2 Introduction to facilitation skills

Objective:-To enable participants understand key principles in facilitation and methods used for delivery of content particularly for adult learning. These sessions will also enable participants understand what motivates adults to learn?
Method:-Lectures and discussions

4.2.1 Basics about Facilitation

A trainer of adult learners is expected to guide and facilitate learning. Therefore he/she should have knowledge of and use facilitation techniques/skills. In facilitation, we do not teach, we guide processes. Facilitation is a conscious process of guiding a group to successfully achieve its task/objectives while functioning as a group. It is a process of enabling a group to work/learn co-operatively and effectively.

Effective communication

Communication is very important in facilitation and hence developing basic communication skills like active listening, questioning, probing, paraphrasing, and personal feedback are critical.

Active listening

Pay attention to what other person(s) say and/or do to get the meaning and to understand the message behind the words/actions/expressions. Neither argue nor interrupt the person talking to you. Listen to the verbal and non verbal message. Listening goes hand in hand with observing.

Questioning

Use more open-ended questions to encourage more thinking and to generate more ideas from participants. Besides, use questions to involve participants (including quiet ones), to get a feeling of participants' thoughts or what they do, and to open up a discussion that explores two sides of a given issue. *Examples* of open questions that one can use include:- What do people here do? How do they…, why…, where…, when….?

Probing

This is linked to art of questioning. Ask more follow up questions in order to gain more/better understanding of a given context or situation being presented by the speaker.

Examples of follow-up questions include:- could you please explain more? Anything else…? Keeping silent in some cases can also be used as a probing technique – it forces the person talking to speak or tell more.

Paraphrasing

Re-phrase or repeat what somebody said but using your own words to make it simple enough for others to understand without altering the message or meaning. This helps to ensure the message being given is clear and understandable.

Personal feedback

Give someone information about the impact of his/her behavior (positive and negative) on you/others (i.e. how the behavior influences you/others). It is a way of helping a person to understand the impact of his/her behavior on others therefore chance to improve.

4.2.2 Important things to do as a Trainer

1. Adequate preparation:

Trainers and facilitators need to take preparation seriously because it is very important in influencing the level of success or effectiveness of training. Create time and adequately prepare both the **content** and **process** that you intent to use prior to any training. As a trainer or facilitator, never assume that you know. Do not take training to be as simple as talking. The level of preparation has implications on the level of seriousness that learners will engage with the learning. This preparation takes into consideration (a) the clarity of what to deliver (content), (b) achievable objectives and (c) choice of most appropriate method. There is need to think through the different available adult training methods and choose the most appropriate in relation to the objectives.

2. Care for the learner(s)

This covers the language used, comfort of venue and keeping the learners updated. Make effort to use the local language that most (if not all) learners in the training clearly understand. This will make the training more enjoyable and will enhance adequate or active engagement of the learners. Ensure the venue is comfortable and clean enough to enhance learning. Keep learners informed of any programs, delays and changes - a sign of caring and valuing them.

3. Principles of adult learners

These make the foundation for whatever we prepare to train adults about (be it planning or implementation phase). It is useful for facilitators and/or trainers to always reflect on the principles and use them as a guide.

4.2.3 Principles of Adult learning

The people who we are training are adults – not children – and adults learn differently from children. Children absorb whatever they are taught because they don't have much life experience.

Adults, however, have a lot of life experience and are interested in how what is taught matches up with what they already know from experience. For this reason we need to remind ourselves on the principles of adult learning and reflect on what we as trainers and facilitators need to do in order make our trainings relevant and to help people learn. We need to reflect on what we as trainers need to do and how best to do it, with reference to the *content, context and objective in question* (see table below}.

Principle	Application-What is expected of the Trainer
Adults have accumulated a wealth of life experience and knowledge	• Encourage adults to share their experience and knowledge • Use the experience as a foundation to build upon the planned content • Connect life experiences and prior learning to new information • Encourage or promote reflection (through some exercise) on the shared experiences and linkage with individual working situation on the ground. This will help the learners to best contextualize the experience

Adults are autonomous, self directed and goal oriented	• Involve adults in the learning process, serve more as a facilitator and not just a supplier of facts. • Encourage and nurture the process of self direction. Adults can share responsibility for their own learning because they know their own needs • Give clear objectives – adults need to know why they need to learn something before undertaking it. They need to see the value. How you deliver the content should clearly show the gap between what they currently do (not well) and what is being promoted (as the right thing) • Organize programs with clearly defined elements, clearly showing how goals will be attained (for each step, get the objectives clear and for each objective get the steps of activities to attain the objective clear). Know what comes first and what comes last.
Adults need to be respected	Acknowledge experiences that they bring, allow free voicing of opinions. Encourage mutual respect and trust among participants and their ideas
Relevancy-oriented and practical	• Help them see a reason for learning something and how to make it applicable in their real contexts. Adults are motivated to learn most when the content meets their immediate needs. • Before a session, explain the need and usefulness (importance) of the session to the participants. Once they are convinced of the usefulness of the session/content, the level of motivation is likely to be high • Have clear and understandable objectives of the training/session to the participants. Objectives will provide a guide into what is expected – provides some direction. This means adequate time put into prior preparation to the training and a good understanding of what the entire training is intended for
Motivated to learn by both internal and external factors	Show how learning will benefit them, create a comfort and appropriately challenging environment
Learn best when they are active participants in the learning process	Limit lecturing and provide opportunities for sharing and exercises that require participants to practice a skill or apply knowledge actively or proactively. Participation in this context is active and not passive
Not all adults learn the same way	Accommodate different learning styles by offering a variety of training techniques
Adults learn more effectively when given timely and appropriate feedback and reinforcement of learning	• Provide opportunity for feedback from self, peers, and instructor. • Effective learning requires corrective but supportive feedback
Adults learn better in an environment that is informal and personal	Promote group interaction, informality, relaxed and a safe atmosphere – a cheerful, relaxed person engages and learns more effectively and easily than one who is fearful, embarrassed, nervous,

tired or angry person

The above hints are a guide. Exact application will entirely depend on the content and objective of the training.

4.2.4 What motivates adults to engage in learning or training activities?

- Social relationships – make new friends or meet members of opposite sex
- External expectations – complying with wishes/directives of somebody with authority
- Social welfare – desire/want to serve others
- Professional advancement – the pride of having a document that shows that s/he attended a training so that s/he is recognized in the community
- Escape/stimulation – getting involved as a way of alleviating boredom or escaping from home or work routine
- Cognitive interests – for the sake of learning
- Looking at the training as a source of useful information that will help solve an immediate need or problem being faced

4.2.5 What makes adults lose the interest or motivation?

- Lack of confidence – not being confident in either themselves or the trainer.
- Lack of course relevance – content not being useful in their context.
- Time constraint- having little time yet with many things to be done.
- Cost – the expense (financial and otherwise) to be incurred can be beyond the participants' affordability.
- Personal problems – problems private to the participants can hold him/her from attending the training.
- Lack of information – not being informed about the training
- Lack of voice - not being listened to or being ignored
- Self esteem – having a low or bad opinion about oneself that makes one to feel not worth

As an adult trainer, think and realistically come out with what you can actually do to use each of the issues raised, whether a motivator or otherwise, to build interest among the adult learners to actively engage in training. What do you do to use the motivating and de-motivating factors as an entry point to encourage active participation in the learning process?

4.2.6 Foundational principles of motivation

Whether confronted with motivating or de-motivating situations of the participants, the most important thing is to raise the motivation or interest of the participants in the training. The interest or motivation can be raised by observing four things (the foundation principles of motivation) when conducting the training:-

(a) **Inclusion** - include both the people and their ideas to enhance involvement.
(b) **Attitude** - use your words and opinion, voice, body language, facial expression, and behavior to help participants like the training or to develop a positive attitude towards the training.

(c) **Meaning**- let participants know and understand why the training is important (the meaning). This will sustain participants' active involvement in the entire process.

(d) **Competence**: encourage and support participants to apply and practice what they get trained about. This will raise their effectiveness and hence build their confidence in using the practice.

4.2.7 Adult learning methods/techniques and their application

There are many methods that a trainer can use. This range from lecture, exchange visits, energizers/Games, simulations, case study, buzz group, brainstorming, role plays, assignment/exercise, video, field trip, exhibition, personal feedback, demonstration, experiments, slides, photography, small groups, storytelling, and presentation, among others. Choice of which method to use, however, largely depends on the objective (is it cognitive based, skill based, knowledge based or a combination of the three). How well a method will be used also calls for adequate preparation on how to link the content and the chosen method of delivery. Below is a range of commonly used training methods and when they are applied.

Table 12: Most commonly used training methods

Training method	When applied
Presentation	Introducing new ideas, topics, concepts or procedure Useful when the audience is big and when the available time is limited, interspaced with discussions, questions and answers
Lecture	• Most commonly used instructional strategy • It's a formal talk usually without interruption from the listeners. Sometimes it is followed by questions, answers and discussion. Can be interactive depending on trainer • Ideas to make it effective as a strategy: be organized - plan ahead & be logical; allow for periodic breaks to minimize sitting and listening for a long time; use visuals; allow for discussion; think of less formal seating arrangement
Brainstorming	• Used to capture a wide range of ideas about some issue. • Encourages creative thinking and free sharing of ideas, experiences • All ideas are accepted and recorded with no discussion/response regardless of usefulness or practicality • Leads to a comprehensive list upon which the learners may reflect and/or pick a discussion there after. Discussion can include development of spin off ideas, refining of ideas, combining and/or reinforcing ideas • A fixed time is allocated to the process
Personal feedback	• Personal feedback gives information about behavior and performance. • It is a way of helping a person identify his/her 'blind spots' and understand the impact of their behavior on others. • Personal feedback helps people improve on their performance • Feedback from others during the training helps you to become aware of your strengths and weaknesses as a facilitator
Small group discussions	Sharing experience, exchange ideas and opinions, problem solving, controversial issues, planning
Buzz groups	• A buzz group is a small group (2-3 people) that discusses a specific topic/issue for a short period of time. Number of people in a buzz group depends on entire

	group size and the task/assignment • Useful during longer plenary sessions and helps in: o Digesting or understanding of the content o Exchange or sharing of ideas & opinions o Reflecting on what has been learnt, how to use it o Drawing on experience and linking it with the discussion • As a trainer; use of buzz groups allow you to: energize people, assess participants engagement, experiences and understanding with reference to the content and to encourage shy people in a non-threatening way Note: (a) invite people to report back, (b) process the output – summarize, analyze. In other words people should see the applicability or implication of the discussion
Experimentation	Experimentation looks at building capacity for self-learning through structured process of trials, reflection and analysis. When we experiment, we are looking for some information e.g. what works? What makes it work?
Demonstration	• Demonstration looks at sharing certain procedure and learning technical skills • It is most effective when learners are concerned with an issue and are looking for an answer • Demonstration aids understanding and retention; require lengthy preparation *Result demo = shows result of some procedure through evidence that can be seen, heard, or felt* *Method demo = illustrates how to do something in a stepwise fashion*
Role play	• Learners assume roles within a simulated situation then deal with that situation • In role plays hypothetical roles may be assumed within artificial situations • In simulations, attempt is to stimulate certain situations that learners will actually have to deal with when they go out to the field, can serve as energizers in a way • The exercise must be followed up by a detailed debriefing in which participants are encouraged to analyze the experience and draw out lessons. Give them chance to talk about how they feel, what they observed, what they learnt and implications in doing their work in future. This is what we call processing the exercise
Energizers/games	• These are exercises (games, songs, filling puzzles) used mainly to enliven sleepy or bored members • Useful in: encouraging interaction, knowing each other, stimulating creative thinking or mind cracking, challenging basic assumptions, illustrating new concepts, team building and fun • Useful in internalizing content especially when linked to content

Exercise 12: Practical use of selected monitoring tools
Participants to be introduced to the various monitoring tools to be used

Session twenty one

4.3 Evaluation of workshop trainings

Objective:-The objective is to evaluate the participants conceptualization of the contents presented and assess the extent to which they can be applied and identify priority areas for technical backstopping.

Method:-The facilitator will first explain and then allow the participants to do the exercise.

Exercise 13: Sample exercise on workshop training evaluation

The session facilitator will explain the importance of the exercise and the scoring rating to be used. The exercise will be done individually following the guidelines below:

Table 13: Workshop evaluation form 1

Session	Usefulness	Applicability	Suggestions
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			

Scores: 1. Usefulness: Very useful = 4, useful = 3, fairly useful = 2, not useful = 1
2. Applicability: Very applicable = 4, applicable = 3, fairly applicable = 2, not applicable = 1
NB: farmers will always want to award higher sores to the best so it may be helpful to follow the order suggested to appropriately get the necessary information

Table 14: Workshop evaluation form 2

Description	Good	Fair	Poor	Suggestion
Coverage				
Practicability				
Content				
Presentation				
Relevance				
Expectations				
Experimentation				
Duration				

Precision				
Applicability				

What needs to be improved next time?	How to improve?

Session twenty two

4.4 Strengthening Farmer Groups / Organizations:

Objective:-To let participants understand and appreciate group dynamics
Method:-Through group exercises
Group Exercise:
In small groups, participants discuss the following:

- Advantages and disadvantages of working in groups or as individuals to carry out agricultural activities.
- Group leadership: Different types of leadership in groups
- What are the characteristics of a good leader?
- What are the characteristics of a bad leader?
- Causes of Conflicts in groups and how to prevent conflicts.
- Conflict resolution and management

There are more advantages when farmers are working as groups rather than individuals. It is easier to access inputs; carry out field activities, like weeding, harvesting, transportation and marketing as well as sharing information.

The groups can either be formal (registered) or informal (not registered). However registered groups have more advantages as they are more recognized and can access inputs, loans and training / capacity building more easily.

Where farmers are working in a group, strong group leadership is important. The groups should have elected officials. Roles of group leaders and members should be clearly defined and active participation encouraged so that decisions represent views of majority of members. Working in groups makes it easier for sweet potato vine production and distribution.

Session twenty three

4.5 Field visit

Objective: - To let participants understand preparations made before field visits are made and areas of concern while in the field.
Method:-Lectures and discussions
The aim of the visit is for the trainees to see samples of seed vine multiplication sites to learn more about what had been taught in theory and some points further clarified by their trainer.

Check list for field visit
Areas of concern
- Look at how land is prepared (Nursery bed, Ridges, Mounts).
- Identify the varieties established.
- Orientation of land/Terrain (Flat, Hilly, Sloppy)
- Accessibility to waster source (Near water source, wet land, irrigated)
- Pest and diseases identification (Symptoms &Signs, Pests) and management strategy.
- Soil type (Sandy, Loamy, Clay e.t.c)
- Any other observations made.
- Comments from participants.

Session twenty four

4.6 Planning and implementation of relevant action plan.

Objective:-To let participants plan and implement action plans agreed on based on what they have learnt in the training.
Method:-lectures and discussions
- Multiplication site identified using the characteristics discussed during the training session.
- Land preparation putting in consideration the method to be applied during the multiplication.
- Clean vine collection from recommended sources.
- Planting of seed vine.

NB- Agricultural extension officers will make follow ups to the farmers' field to ensure the right procedure is followed.
Appendix 1: Developing training scheme for Promoters (30 minutes)

Important: Trainees should be guided to develop the training schemes for their trainees by completing the table below:-

Table 15: Template for developing the trainee's scheme

Date: ---------------------------------------Venue--

Session	Description of activities/energizers	Time		Materials
		Start	End	
1				
2				
3				
4				

Prepared by …………………………………..

Appendix 3: Attendance list of participants at the Training held at ………………on ………….

Category of Trainees: …………………………………..

No.	Name	Address	Signature
1			
2			
3			
4			
5			
6			

Facilitated by ……………………………………………

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