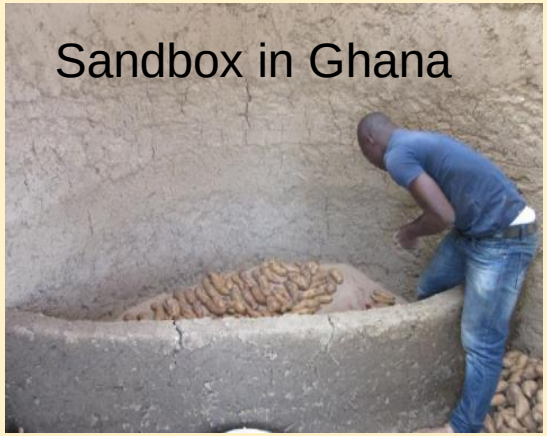
# Extending Access to Sweetpotato Roots using Stepped Pit Stores and Sand Boxes

**Prepared by Erna Abidin and Team (CIP-Ghana)**




Healthy plants produced quality roots

Stepped pit in Malawi

**OFSP, when it started**

After being stored in the sand storage: 4 months in Ghana & 6.5 months in Malawi

**OFSP, after 6.5 months stored in sand**

# Background and Justification

- The "Triple-S" (**S**torage in **S**and and **S**prouting) method aimed
  - → To store the sweetpotato storage roots in sand at room temperature for subsequent use in planting material production.
  - → **Research finding**: the 'Triple S' technique can store the roots for a few months in sand during dry season to in-timely produce planting material in the planting season.
- Scaled up Triple S with the research question:
  - → Can we develop from the 'Triple S', a technique to produce fresh storage roots during the prolongation of dry season aimed at combating hunger or food shortage in the rural poor area?
- Storage in Sand (Double S) was brought into action research conducted in Northern parts of Malawi and Ghana, the project was funded by USAID-OFDA with multi-partners incl. relevant government agencies and NGOs and led by CIP.
  - → The project titled: ***'Breaking postharvest bottlenecks: long-term sweetpotato storage in adverse climates'***
  - → Research period: 18 months (Nov 2013 to June 2015)

## The USAID-OFDA project ('Phase I'):
## 'Long-term sweetpotato storage in adverse conditions'

**Objective:** to evaluate long-term storage of sweetpotato on-farm in contrasting agro-ecologies using improved ventilation in combination with other practices such as storage in sand.

**Strategic Objective:** with good storage systems in the tropics, a shelf life of 2 months is more than can be expected.

→ The results could improve household food, nutrition security and markets

**Output deliverable Chain:** Participatory Adaptive Development of postharvest management for household and markets

**Impact Pathway:** This project is a short-term effort that will test storage options which may be taken to scale as a follow up with partners in Ghana, Malawi and their respective regions

**OFSP varieties were included in the trials among other types of sweetpotato.**

→ We needed to test if it is true that OFSP could not be stored longer compared to the white types of sweetpotato.

# Trials set up

| In Ghana | In Malawi |
|---|---|
| **5 communities (100 HHs)-Bawku, Upper East Region** | 3 communities (90 HHs) – Mzimba and Kasungu districts, Central and Northern Regions |
| **at 11º N and ~220 masl** | at the 13º S and mid-elevations of ~1200 masl |
| **2 OFSP and 1 white variety** | 1 introduced OFSP, 1 white and 1 yellow (local) varieties |
| **Training on sweetpotato production, multiplication, pest and disease management, postharvest handling and OFSP utilization and processing** | Training on sweetpotato production, multiplication, pest and disease management, drip irrigation, postharvest handling and OFSP utilization and processing |
| **Traditional curing practices and storage methods: traditional heaped vs sandbox** | Traditional curing practices and storage methods: stepped pit (improved local storage) and granary with dry sand vs Afghan ventilated storage without dry sand. |
| **Baseline and endline survey** | Baseline and endline survey |

In both countries weight loss, test taste, temperature, relative humidity and beta-carotene analysis (**Malawi**) were collected and market assessments were done

# Results and Findings

## From Endline survey:

**In Ghana:** farmers preferred the sandbox to the traditional moistened heap

| VARIETAL STORABILITY AND MARKET DEMAND AT BUYA-NATINGA/OLD NINKONGO (BAWKU) | | | |
|---|---|---|---|
| **Variety/Cultivar** | Max. Storage Length (before the project) in Months | Max. Current Length of Storage in Months | Comments |
| **Kuffour (OFSP)** | 1 month | 4 months | Good when produced early |
| **Obaari White** | 3 months | 7 months | Best market demand |
| **Asankunaboro** | 3 months | - | - |
| **Awaal** | 3 months | - | - |
| **Asaamadek** | 2 months maximum | 5 months | Better market |
| **Apomuden (OFSP)** | Anticipate poor storage | 4.5 months | **Poor market** demand, mainly for HH consumption (**baseline**), **now**, a **high** demand in the market. |

## Conti'd results and findings in Ghana

| VARIETAL STORABILITY AND MARKET DEMAND AT NEW NINKONGO (BAWKU) | | | |
|---|---|---|---|
| **Variety/Cultivar** | Max. Storage Length (Before the Project) in Months | Max. Current Length of Storage in Months | Comments |
| **Asaankasnaabbogor** | Good storage | - | Good market |
| **Asaamadek** | Stores well (2 months) | - | Good market—WFSP |
| **Obaari** | Good storage | 6.5months | Best market |
| **Kuffour (OFSP)** | Poor storage | 4 months | Early market |
| **Awaal** | Good storage | - | Good market |
| **Apomuden ('Nasara Dankali') - OFSP** | Storage probably poor. Yet to observe how it stores as it has just been introduced. | 4.5 months | No market baseline, but now people market it. |

# Results and findings in Malawi

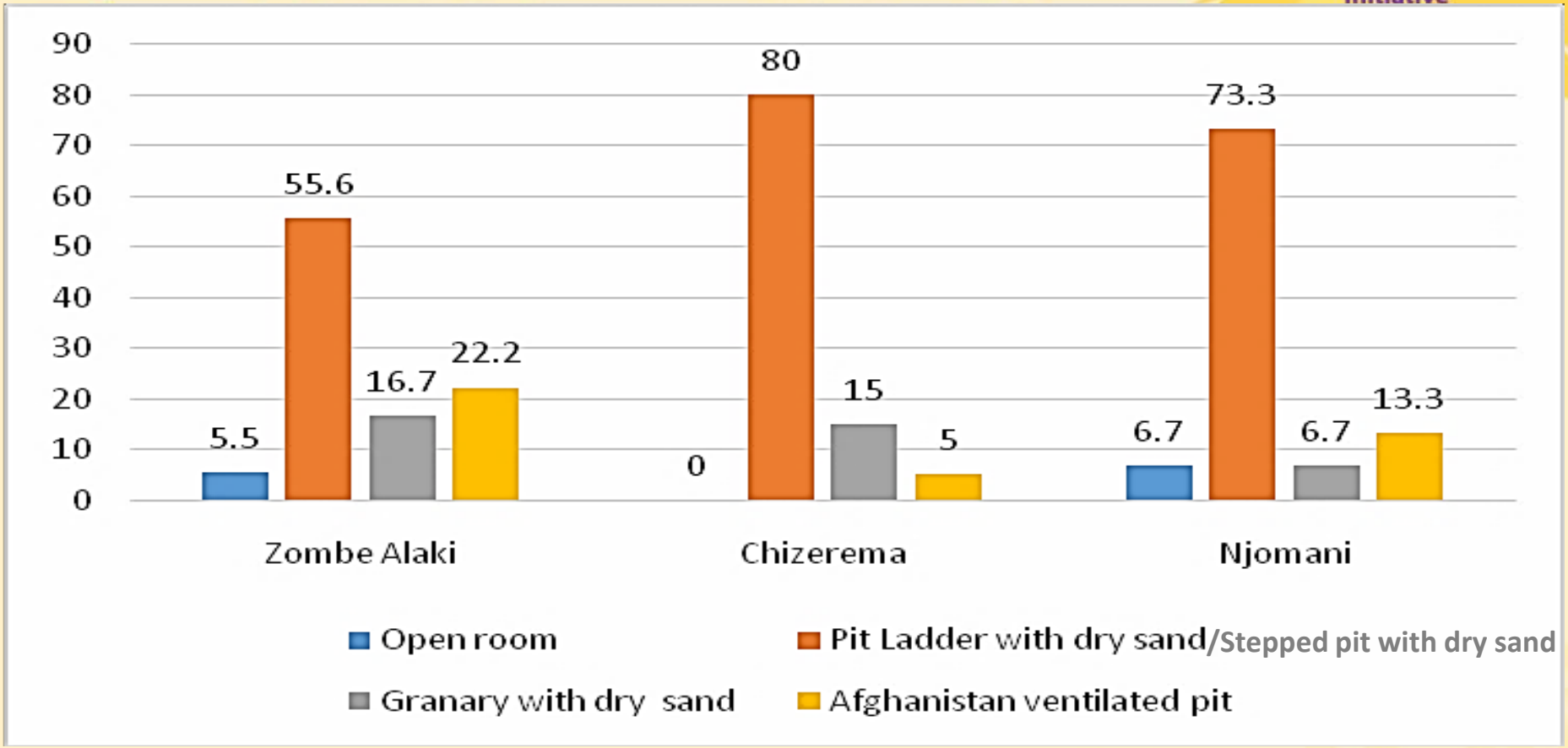
## From Report & Endline Survey:

- The OFSP was stored for over 6 months, with losses of less than 40%. We found the storage root losses for white and/or yellow flesh sweetpotato were more than 40%. Highest losses , we found from Afghan ventilated pit, and least losses from stepped pit storage with dry sand. Sprouting was mostly recorded from stepped pit storage.
- Farmers indicated that OFSP has an impact in people's livelihoods especially in the areas of food security, improving nutrition and wealth. The expanding shelf-life of OFSP strongly contributed to this impact.

| BETA-CAROTENE ANALYSIS IN JUNE AND NOVEMBER 2014 | | |
|---|---|---|
| | Beta-carotene (µg/g) | |
| **Varieties** | June (1.5 MAS) | November (6.5 MAS) |
| **Local ('Kenya' & 'Zimbabwe')** | 10.7 | 7.4 |
| **OFSP, 'Zondeni'** | 83.9 | 91.8 |

From 100 g of 'Zondeni' there are 9,180 µg of beta-carotene, equivalent to 765 µg of retinol activity equivalents, which is more than 150% of the recommended daily allowance for a child under 5.

# Farmer preference for sweetpotato storage options in Malawi by community




Source: Endline Survey in Malawi, 2015 (77% women and 23% men; n = 90 – direct participants)

# SCIENTIFIC PUBLICATION

SP08 - 03

Sand storage, an innovation to extend the shelf-life of fresh sweetpotato for home consumption and market sales - findings from Malawi and Ghana

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INTRODUCTION

A uni-modal rainfall pattern with long dry season causes a fairly short harvest season with abundant sweetpotato and low prices in the markets. Out of season, sweet-potato becomes scarce and expensive. Mostly, the crop is consumed, processed, or sold shortly after harvest. Farmers have developed various methods to extend sweetpotato shelf-life, i.e. storage in soil, grass or ash, storage in pits, simply left in the ground and harvested piecemeal as required, or processed into sun-dried chips. Normally these indigenous storage methods are only effective for a month or two, after which quality declines due to rots, infestations by pests and physiological deterioration. Recently the "Triple-S" (Storage in Sand and Sprouting) method was developed as a way to store the roots at room temperature for subsequent use in planting material production. Since this method can effectively store sweetpotato for a few months for planting material production, we reasoned it could also be applied to fresh root storage. Experiments were conducted to develop and evaluate methods at the community level in Ghana and Malawi.

MATERIALS AND METHODS

Data of weight loss, taste test, RH and temperature were collected, at regular intervals up to 6.5 months in Malawi. Market assessment and β-carotene analysis were done at 1.5 and 6.5 months in Malawi and up to 4 months in Ghana. Weight loss included shriveling, rots and pest damage. Genstat (2005) and STATA program were used to analyze the data.

RESULTS & CONCLUSION

ACKNOWLEDGEMENT

1. Participation at the World Congress for Root and Tuber Crops in Nanning, China, 18-22 Jan 2016 (Poster)

2. Peer reviewed Journal article:

Abidin, P.E., J. Kazembe, R.A. Atuna, F. K. Amagloh, K. Asare, E. K. Dery and E. E. Carey 2016. Sand storage, extending the shelf-life of fresh sweetpotato roots for home consumption and market sales. Journal of Food Science and Engineering 6: 227-236; doi: 10.17265/2159-5828/2016.04.005

# The USAID-OFDA project (Phase II): a one-year project period: July 2017 to June 2018

## ‘Extending Orange-fleshed Sweetpotato Availability for Vulnerable Households through Good Agricultural Practices and Post-Harvest Storage’

### Overall Goal

To identify effective approaches to scaling out nutritious orange-fleshed sweetpotato storage methods to vulnerable populations in northern Ghana and Burkina Faso.

**Strategic Objective:**
Identify effective means of extending seasonal availability of nutritious orange-fleshed sweetpotato for improved nutrition and livelihoods in drought-prone northern Ghana through household storage.

**Indicator (A):**
Projected increase in number of months of food self-sufficiency due to distributed seed systems/agricultural input for beneficiary households.

**Indicator (B):**
Number of people benefiting from seed systems/agricultural input activities, by gender.

## Necessary Pre-condition/Factors for scaling (ref. Wigboldus and Brouwers 2016. WUR)

- Two technologies:
  - (1) Storage in Sand (Double-S)
  - (2) Storage in Sand and Sprouting (Triple-S)
- Good Agricultural practices (GAP) method to accompany the technologies
- Identified efficient and effective means of disseminating information/knowledge
- Identified end users who are going to adapt the technologies to their circumstances
- Measurement of rate of adoption and impacts

**Project Plan:**

- Effective means of mass communication: radio and video
- Effective extension agents for adaptation and adoption of sustainable technologies
- Target users including women
- Orange-fleshed sweetpotato varieties
- Storage in sand technologies
- Knowledge and Skills on OFSP technologies
- Strong and Established Partnership

# Vision

Extending orange-fleshed sweetpotato (OFSP) availability for vulnerable households to improve food security, nutrition and incomes through good agricultural practices and post-harvest storage in drought-prone northern Ghana and Burkina Faso benefitting women and children.

## Project Outcomes

1. Improved **OFSP production** through good agricultural practices and **extended the shelf-life of sweetpotato roots** through locally improved sand storage technique will improve food security, nutrition and incomes of vulnerable households including women and children.
2. Improved **sweetpotato seed systems** in the drought-prone northern Ghana and Burkina Faso through storage in sand and sprouting (Triple-S) method followed by proper multiplication management of OFSP planting materials.

# Total numbers of beneficiaries targeted for scaling

- **Direct beneficiaries = 800**

  **(**20 direct beneficiary households (i.e. DVMs/root producers) *5 members benefit per household*4 sites*2 regions)
- **Indirect beneficiaries = 4,800**

  (Every 800 direct beneficiaries will influence 6 additional people cannot be estimated a priori, but will be assessed in the end-line survey). These are the beneficiaries adopting storage practices as a result of exposure through extension efforts including radio, field days and video.
- **WFP-MOFA joint-program project** on the OFSP Production and Storage in Northern Region (NR) and Upper West Region (UER) backstopped by CIP-led project.

  → **Direct beneficiaries: 1,120** smallholder farmers

  → **Indirect beneficiaries: 5,600** individuals in 500 districts in UER and NR
- **Representative farmers and extension officers from Burkina Faso** participating in the project activities in Ghana
- Percent of total population in the selected intervention villages: 20%.
- **Spillover and Observers**. The spillover beneficiaries are the beneficiaries who might be involved in the Jumpstarting OFSP, USAID-SPRING, etc., while observers who were never involved in any of the OFSP projects but heard from radio, video and other extension efforts.

# The essence of Theory of Change in Theory of Scaling

## Assumptions about how change is expected to happen

## (ref. Wigboldus and Brouwers 2016. WUR)

**Assumptions with the envisaged change process in scaling out:** Triple- and Double-S technologies

Through extension efforts, incl. radio, video, farmers field school method, farmer-participatory research, ToT, partnership

**Assumption as appropriate strategies:** Capacity strengthening with strategic approaches: Farmer Field School, Farmer-managed Research, ToT

People tend to copy successful innovation

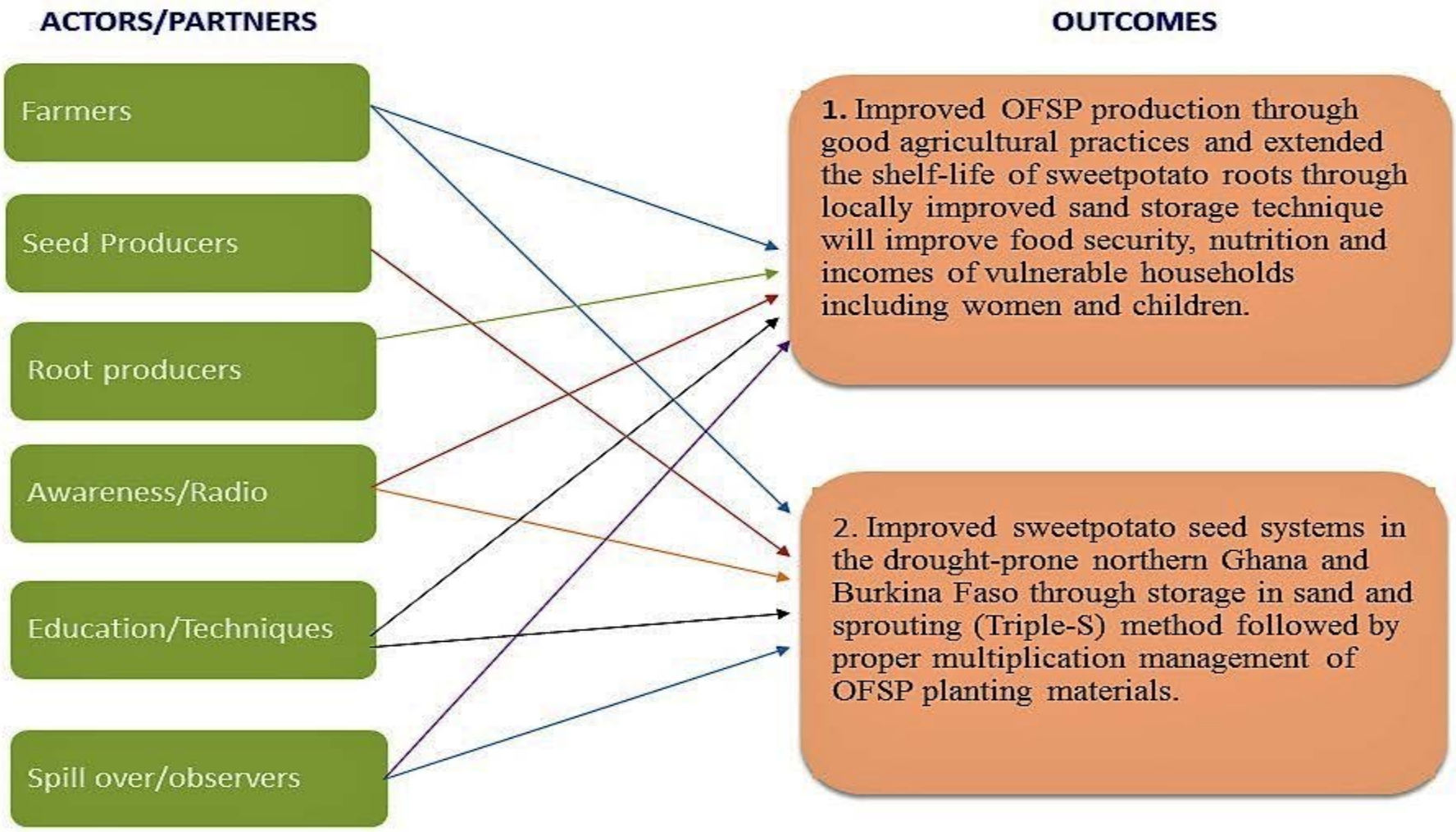
**Assumption on feasible change:** **OFSP an entry point**

People consciously want to eat healthy food

**Fundamental Assumption**: Innovated sand storage

Short shelf-life of sweetpotato is short, ~1 month

# Actor-outcome matrix



# Actor-centered Theory of Change for Scaling and its Impact pathway

**To take Double-S to scale, testing different scaling approaches**

- Site selection through engagement with existing groups of experienced producers; conduct initial rapid appraisal, and consultation to identify target villages.
- Conduct baseline assessment key aspects of relevant knowledge and practices (including key OFDA sub-sector indicators), with careful sampling of various extension target groups.
- Establish initial production plots with groups at selected sites to be used for demonstration trials, field days and storage; sign boards atthe demonstration site.
- Draw up extension/training plans for each of the extension intervention approaches and implement according to calendar.

**To adapt and evaluate the stepped pit storage method developed in Malawi in the Ghanaian setting**

- Engage with farmer groups, discuss and agree with storage methods/demonstration design to be used.
- Discuss and agree best management practices to be used during production, storage and monitoring of sweetpotato stores.
- Discuss and agree best management practices to be used during production, storage and monitoring of sweetpotato stores.
- All actors implement sweetpotato storage demonstration trials, multipliers indicated for triple-S.
- Group members contribute to planning and participation in extension programming, market demonstration, field days and radio programing; participate in periodic evaluation/planning meetings.

**To evaluate the Triple-S (storage in sand and sprouting for seed) method of planting material production in Ghana**

- Site selection; identify vine multiplier associated with each group
- Baseline assessment is also emphasized on seed.
- Establish initial production plots with groups at selected sites to be used for demonstration trials, field days, and storage; sign boards at the demonstration site; small roots from production used for Triple-S at main demonstration site.
- Sprouting of roots in DVM nursery, comparing Triple-S production to conventional practices.

**Assumptions**

- Good farmer sensitization
- Appropriate training
- Good rainfall patterns
- Breeders providing good varieties
- Understand benefits of OFSP
- Common objective and interest
- Communities need to be educated and aware
- Adequate training, capacity of Radio station
- Awareness of the nutritional values of OFSP
- Awareness of the VitA issue
- Regular communication with value chain actors
- Awareness that OFSP is good for vulnerable people including women and children
- Continue updates on literatures and logistics
- Resource availability
- Flexibility

**Actor-level outcomes**

**Farmers**: Increased OFSP production, Reduced post-harvest losses, Increased incomes; Assess diversified food/dishes by women, increased food and nutrition security.

**Seed producers/farmer groups**: Strong link between breeding and seed system – provision of desired varieties to farmers; Women empowerment when in group.

**Awareness/Advocacy/Radio program**: Awareness creation and sensitisation, Increase in production of OFSP, Increase in consumption of OFSP and extending the consumption during the dry season, Food diversified and increased income, Improved nutritional status especially for Vit A, Expect to see and increase in product and consumption of product after advertising, increase in family income and improved nutrition of consumers of the product.

**Education and technique actors**: Increase vit A in food, Improved food and nutrition security in the drought-prone areas, Increase incomes for vulnerable people and resource-poor farmers including women and youth.

**Outcome 1:** . Improved OFSP production through good agricultural practices and extended the shelf-life of sweetpotato roots through locally improved sand storage technique will improve food security, nutrition and incomes of vulnerable including households women and children.

**Outcome 2:** Improved sweetpotato seed systems in the drought-prone northern Ghana and Burkina Faso through storage in sand and sprouting (Triple-S) method followed by proper multiplication management of OFSP planting materials.

**Vision:** Extending orange-fleshed sweetpotato (OFSP) availability for vulnerable households to improve food security, nutrition and incomes through good agricultural practices and post-harvest storage in drought-prone northern Ghana and Burkina Faso benefitting women and children.

**External Factors:**

Household:

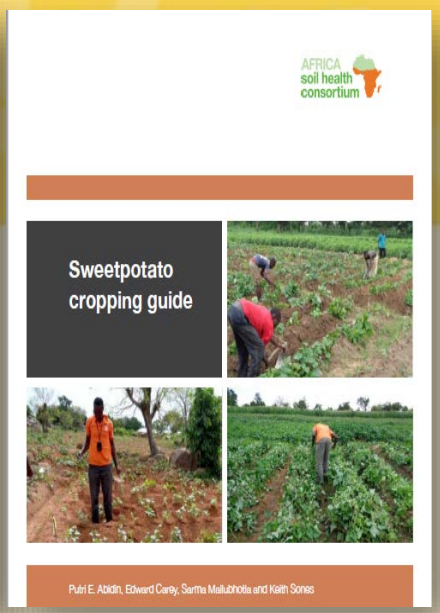
- Literacy
- Language barriers
- Gender dynamic
- Means to participate

External Environment:

- Appropriate incentives
- Government health budgets
- Infrastructure and service providers
- Weather and climate
- Regulatory environment
- Conflicts
- Disease and epidemics
- Pest incidence and animal destruction

# Progress: 25 July – 13 Sep 2017

| Activities/Outputs | Progress | Notes |
|---|---|---|
| **Collecting information/preliminary survey & Approaches** | Completed | Began on 25 July 2017: (1) core regions (UER and NR) through group and individual discussion with gender segregation, (2) spillovers and observers (Burkina Faso (BF), NR & UWR, joint program supported by WFP project), Spillover groups in Navrongo (former DVMs and root producers established by Jumpstarting. |
| **Site selection to identify target communities, trial plots and planting.** | Completed | Core sites (8 sites in 2 regions), spillover in Navrongo, former Jumpstarting project), Observers (BF, NR and UWR). We have chosen areas for trial plots that accessed to irrigation. |
| **Planting 2 OFSP varieties, including training on GAP** | Completed | Began on 25 July. 2 OFSP: Apomuden and Nan varieties (the core beneficiaries – 20 per site per region), representative from observers of BF, spillover (Navrongo), observers from WFP project through MOFA, USAID-SPRING, and MEDA. |
| **Field days** | 2 field days | Planting and Fertilizer application; An addition field visit by a small team of the project. |
| **Extension training plan and IEC materials** | done | (1) Training on GAP (planting and fertilizer application); (2) 4200 IEC materials printed (Sweetpotato cropping guides, QDPM protocol, GAP brochure, Triple S), plus enough ToT OFSP for processing and utilization, cookbook (remaining books from Jumpstarting), (3) GAP with illustration for illiterate, protocol for Double S are in a progress to be finalized, (4) 2 videos (not yet being edited) during planting and fertilizing the crop taken. |




SPHI
Sweetpotato for Profit and Health Initiative

**ACKNOWLEDGEMENT:**

- CIP Management Team and CIP staff
- USAID-OFDA
- BMGF - Jumpstarting

**Left:** During Fertilizer Application

**Right:** 2 weeks after fertilized

# Thank you for your attention