Cover photo: Palatabilty test, Rakai, Taken by Joweria Namakula, NaCRRI, Uganda

Delivering and Disseminating Biofortified Crops in Uganda

Midterm Report
January–June 2013

Prepared for:
HarvestPlus

Submitted by:
International Potato Center (CIP)

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International Potato Center (CIP), National Crops Resources Research Institute (NaCRRI)/National Agricultural Research Organization (NARO), Makerere University (MAK) and BioCrops

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Prepared by

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Summary

During this reporting period, the International Potato Center (CIP) supplied 30 (10- Vita and 20-Kabode) cleaned up (virus free plantlets) to the National Crops Resources Research Institute (NaCRRI). Makerere University (MAK) is conserving in vitro plantlets of three orange sweetpotato (OSP) varieties (Kabode, Vita and Ejumula) as backup for NaCRRI and BioCrops Ltd. MAK multiplied and maintained the OSP in tissue culture before CIP delivered OFSP tissue culture plantlets to NaCRRI. BioCrops has since January 2013 delivered 32,000 vines (13,000 of Ejumula, 11,000 of Kabode and 8,000 of Vita) to HarvestPlus vine multipliers. CIP in collaboration with NaCRRI of the National Agricultural Research Organization (NARO) has harvested all second season 2012 on-farm trials in the districts of Kabale, Isingiro, Rakai, Buyende and Oyam. At total of 42 trials were harvested and nine palatability tests were conducted. SPK 004/2006/1136 had the highest yield across districts (13.5 tons/ha) followed by NASPOT7/2006/292 (8.7 tons/ha). The check clone NASPOT 10 O yielded 10.2 tons/ha. During the palatability tests, farmers preferred NASPOT 7/2006/292 and SPK 004/2006/1136 for their sweetness, starchiness, good flavor and general appearance. CIP and NaCRRI also setup on-farm trials for season A 2013 in the districts of Kabale, Isingiro, Rakai, Buyende and Oyam. The trials were setup with six OSP clones; Ejumula (OP) 2012/3, Ejumula (OP) 2012/11, Ejumula (OP) 2012/9, Ejumula (OP) 2012/10, Resisto (OP) 2012/1 and NASPOT 10 (common check). CIP has also planted materials for post-harvest experiments in Masaka, Rakai, Mukono and Soroti districts. Four varieties (Kabode, NASPOT 8, NASPOT 1 and the local variety 'SOCADIDO) were planted on a total of 1.5 acres of land (1500 heaps of each of the varieties respectively) per farmer. The post-harvest experiments will be setup between August and September 2013. NASPOT7/2006/292 and SPK004/2006/1136 performed well during the 1st and 2nd season 2012 trials, and documentation is underway for their release during the next variety release this year.

1.0 Introduction

This is the second year of the project, "Delivering and Disseminating Biofortified Crops in Uganda," (BIOFORT Uganda). BIOFORT Uganda is a 5 year project with annual contracts to partners. The project is implemented by five partners, the International Potato Center (CIP), HarvestPlus, Makerere University, Department of Agricultural Production, College of Agricultural and Environmental Sciences (MAK), the National Crops Resources Research Institute (NaCRRI) of the National Agricultural Research Organization (NARO), and a private company, BioCrops Uganda Limited. The second year of the project is a continuation of year 1 activities.

It was realized that the lack of a good supply of virus planting material didn't allow sustainable cultivation of the susceptible orange sweetpotato (OSP) varieties. This would make it difficult to exploit the benefits of the vitamin A rich sweetpotato varieties. Under this project, Makerere University Department of Agricultural Production (MAK) is providing virus free tissue culture derived sweetpotato plantlets/cuttings to the private company, BIOCROPS (U) Ltd, for the initial commercial multiplication of disease-free material. Initially, HarvestPlus would deliver the expanded volumes of clean vines to farmers through farmer groups and/or zonal vine multipliers, a role that is envisaged to be taken over by the private/commercial sector. During this year 2 of the project, MAK is conserving virus free plantlets as a backup and for supply of

starting clean stock to NaCRRI and BIOCROPS (U) LTD. NaCRRI is continuing with breeding activities, on-station and on-farm trials while BioCrops is continuing with multiplication and supply of virus free OSP materials to HarvestPlus vine multipliers. CIP has continued coordinating all activities and to lead research on Triple S, post-harvest handling of sweetpotato roots and on-farm evaluation of OSP clones in partnership with NaCRRI. This is the mid-term report for the second year of the project with component objectives.

1.1 Project Objectives

The project's main objectives are to:

1. Establish a sustained supply and conserve virus-free plantlets of major OSP varieties at Makerere University and at NaCRRI.
2. Establish capacity of a private sector operator (BioCrops) to produce cuttings of primary foundation material.
3. Facilitate the adoption of at least three new OSP varieties to local conditions of northern and western Uganda.
4. Identify in every district, two commercially oriented, large-scale vine multipliers with excellent management skills.
5. Have at least 30% of target households in areas with prolonged dry seasons (>4 months) adopt the Triple S technology.
6. Test and refine recommended practices for curing sweetpotatoes by smallholder farmers to increase longevity in storage.

2.0 Major Accomplishments during the reporting period

2.1 Selecting farmers to host curing and storage trials

A total of 6 farmers were selected in Rakai, Masaka, Mukono and Soroti to participate in the curing and storage trials for the year 2013 (2 per district) (See Table 1 for details). The farmers were selected with the help of our partners, Community Enterprises Development Organization (CEDO), (Rakai and Masaka) and Volunteer Efforts for Development Concerns (VEDCO), Mukono.

2.2 Planting of Materials for post-harvest experiments

Materials for post-harvest experiments were planted in Masaka, Rakai, Soroti and Mukono.
In Masaka, Rakai and Mukono, we planted 1.5 acres of land with 6000 heaps (1500 heaps each of Kabode, NASPOT 8, NASPOT 1 and the local variety 'SOCADIDO', respectively) (Photo C). In Soroti we planted a total of two acres (half an acre each with NASPOT 10, NASPOT 1, NASPOT 8 and SOCADIDO). The roots from the materials will be used to set up curing and storage experiments between August and December 2013, when the weather is expected to be most favorable for those experiments.

2.3 Pre-harvest monitoring/evaluation of on-farm trials

Pre-harvest evaluation of on-farm trials was done in Kabale, Isingiro and Rakai districts. Trials were assessed for sweetpotato virus disease (SPVD), Alternaria blight and vigor. All the trials

were progressing well, but the prolonged dry season had affected them. Four trial plots (3 Isingiro, and 1 Kabale) were lost due to either farmers' abandonment or grazing by animals.

Table 1. Farmers selected to participate in curing and storage experiments

Name of farmer	Sub county	District
Ssebirumbi Alex	Bukakata	Masaka
Buyondo Fluge	Bukakata	Masaka
Ssentongo Matia	Lwankoni	Rakai
Tebandeke John	Kirumba	Rakai
Odur Francis	Nabale	Mukono
Kakooza Joseph	Nabale	Mukono
Ekinyu Eugene	Kyere	Soroti

2.4 Harvesting OSP trials in Buyende, Oyam, Isingiro, Kabale and Rakai

Second season OSP trials were harvested in Isingiro, Kabale, Buyende and Oyam districts. A total of 42 trials were harvested. SPK004/2006/1136 had the highest average yield (13.5 tons/ha followed by the test clone NASPOT 10 O (10.2 tons/ha) (see Table 2) (Photos A, B). The second promising clone NASPOT7/2006/292 yielded on average 8.7 tons/ha. The trials in Buyende and Rakai experienced a prolonged drought period and it could have contributed to the low root yields observed in the second season. The weather was relatively good in Oyam, Kabale and Isingiro hence the higher root yields observed in those areas. All clones had SPVD scores below 3 (see Table 2 for details). SPK004/2006/1136 was the most stable across environments for yield, SPVD and harvest index (See Figiure 1). During harvesting, we conducted nine palatability tests (Buyende-2, Oyam-1, Rakai-3, Isingiro-2 and Kabale-1) (Photo D). Generally farmers preferred SPK004/2006/1136 because it is vigorous and it is tolerant to drought. During the palatability tests, farmers in Buyende and Oyam preferred SPK004/2006/1136 followed by NASPOT7/2006/292. Farmers in Kabale, Isingiro and Rakai preferred NASPOT7/2006/292 followed by SPK004/2006/1136. SPK004/2006/1136 was preferred for its starchiness, good flavor and general appearance. NASPOT7/2006/292 was preferred for being very sweet in addition to all the attributes of SPK004/2006/1136. Preparation of a release document is underway for the next variety release this year for clones SPK004/2006/1136 and NAS7/2006/292 that performed well and were more preferred by farmers.

Table 2. Average performance of 3 OSP clones evaluated in on-farm verification trials in Kabale, Rakai, Isingiro, Buyende and Oyam districts

Buyende

	Mean Root yield (tons/ha)	Mean SPVD Symptom score	Mean harvest Index	Flesh color	Mean Weevil damage score	Mean Alternaria Symptoms score	Mean % Marketable Roots
NASPOT 10	9.2	1.6	0.5	7	3	1	62.2
NASPOT	3.9	1.9	0.1	8	2	1	34.7

7/2006/1185							
SPK 004/2006/1136	12.4	2.1	0.4	7	2	1	56.2
NASPOT 7/2006/292	4.5	2.6	0.2	8	2	1	45.2
Mean	7.5	2	0.3	7	2.3	1	49.6
Oyam							
NASPOT 10	13.2	2	0.7	8	4.4	1	61.6
NASPOT 7/2006/1185	6.7	2.1	0.4	8	3.7	1	57.4
SPK 004/2006/1136	14.3	2.6	0.7	8	3.3	1.6	59.4
NASPOT 7/2006/292	10.3	2.4	0.5	8	3.9	1.4	65.3
Mean	11.1	2.3	0.6	8	4	1.3	60.9
Isingiro							
NASPOT 10	8.2	2.1	0.3	7	2.9	1.6	37.3
NASPOT 7/2006/1185	8.9	2	0.3	7	2.0	1.4	36.1
SPK 004/2006/1136	15.2	2.4	0.4	8	2.6	2.0	37.8
NASPOT 7/2006/292	11.8	2.3	0.3	8	2.3	1.6	35.0
Mean	11.0	2.2	0.3	8	2.4	1.6	36.6
Kabale							
NASPOT 10	11.6	2.9	0.5	8	1.4	1.6	48.6
NASPOT 7/2006/1185	6.5	2.3	0.3	8	1.4	1.7	38.1
SPK 004/2006/1136	14.6	2.9	0.5	8	1.4	2.7	37.7
NASPOT 7/2006/292	10.9	2.3	0.5	8	1.4	1.9	43.1
Mean	10.9	2.6	0.4	8	1.4	2.0	41.9
Rakai							
NASPOT 10	13.2	2.7	0.4	8	3.9	1.3	40.2
NASPOT 7/2006/1185	6.7	2.6	0.3	8	3	1.3	32.9
SPK 004/ 2006/1136	10.9	2.7	0.4	8	3	1.4	41.3
NASPOT 7/2006/292	5.6	2.7	0.2	8	3.1	1.4	34.0
Mean	7.7	2.7	0.3	8	3.3	1.4	37.1
$LSD_{0.05}$	2.8	1.3	0.04	NA	0.3	0.2	4.5
CV	24.1	31	21.2	NA	29.5	29.5	21.1

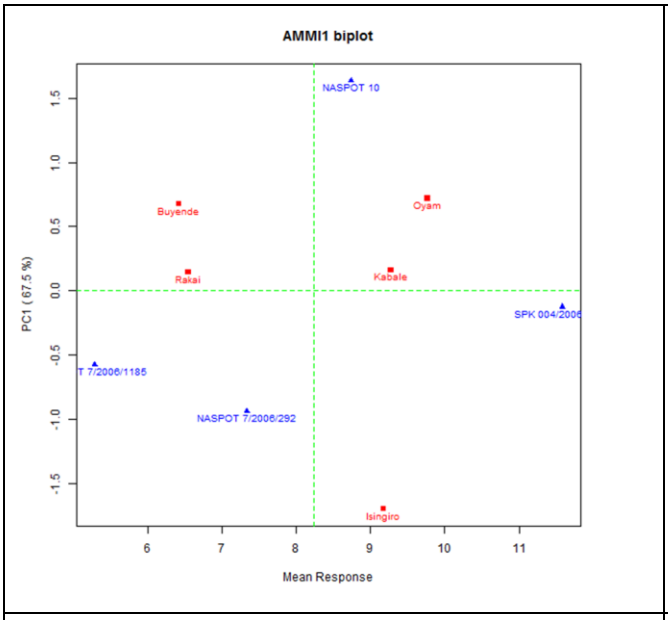
LSD- Least significant difference at 5 %, Fresh color: 7-Pale orange, 8- Deep orange, NA - Not available

SPVD and Alternaria blight scored on a scale of 1-9: 1=no symptoms, 9=very severe symptoms

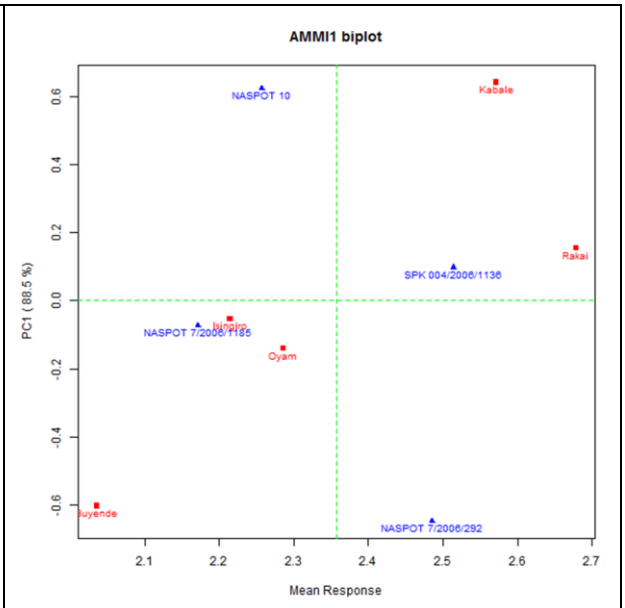
Performance of OSP clones across districts (farms)

Clones	Mean Root yield (tons/ha)	Mean SPVD Symptom score	Mean harvest Index	Flesh color	Mean Weevil damage score	Mean Alternaria Symptoms score	Mean % Marketable Roots
NASPOT 10	10.2	2.3	0.5	7	3	1.3	50
NASPOT 7/2006/1185	6.3	2.2	0.3	8	2.4	1.3	39.8

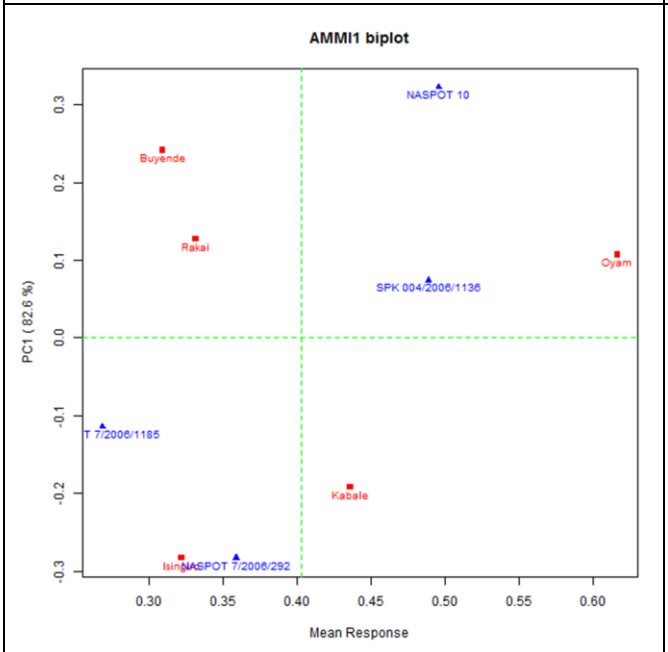
SPK 004/2006/1136	13.5	2.5	0.5	7	2.5	1.8	46.4
NASPOT 7/2006/292	8.7	2.5	0.4	8	2.6	1.5	44.5
Mean	**9.7**	**2.4**	**0.4**	**NA**	**2.6**	**1.5**	**45.2**



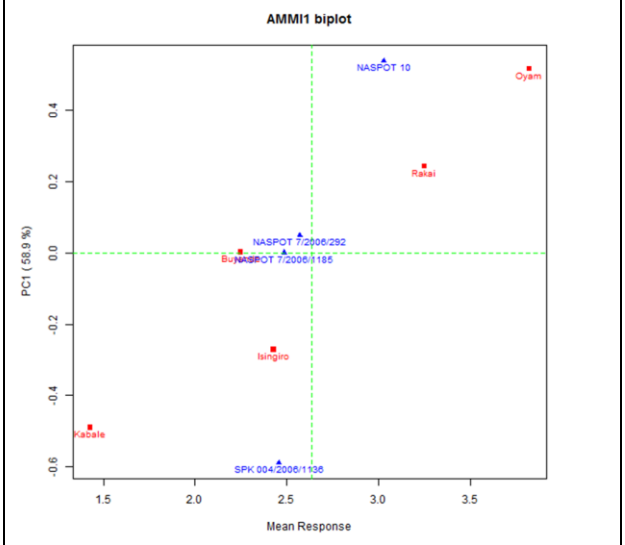
Root Yield



SPVD



Harvest Index



Weevil Damage

Figure 1. Biplots of mean root yield, SPVD, harvest index, and weevil damage and the first interaction principal components axis (PCA1) scores of 4 orange sweetpotato clones grown in on-farm trials in 5 districts in Uganda

2.5 Planting on-farm trials

On-farm trials for season 2013A were established in Isingiro, Kabale, Rakai, Buyende and Oyam districts in in the second week of June 2013 (Photo E). The trials were established late due to shortage of planting materials. We planted a total of five trials (1 trial per district) with six OSP clones, Ejumula (OP) 2012/ 3, Ejumula (OP) 2012/11, Ejumula (OP) 2012/ 9, Ejumula (OP) 2012/10, Resisto (OP)2012/1 and NASPOT 10 (common check). We planted 5 heaps per clone per farmer with 3 cuttings (30 cm) per heap or 15 cuttings on a ridge at a spacing of 30 cm between cuttings and 1 m between ridges. The heaps were spaced 1 m from each other.

2.6 Establishment of in-vitro OSP stock at NaCRRI

CIP provided NaCRRI with 10 cleaned-up (virus-free plantlets) of Vita and 20 of Kabode from Makerere University, Kabanyolo, for establishment of an in-vitro stock. To-date NaCRRI has a stock of 59 in-vitro virus-free plantlets of Vita and 32 of Kabode at the NaCRRI tissue culture lab for maintenance as backup stock for BioCrops. Ejumula and Kakamega from CIP will be provided to BioCrops when ready.

Table 3. Status of progress by NaCRRI

Planned activities	Targets	Actual Achievements	Remarks
Evaluation of On-farm trials	Conduct on-farm trials with extensive farmer participation in key target areas	5 OSP clones (Ejumula(OP)/2012/3, Ejumula(OP)/2012/9, Ejumula(OP)/2012/10, Ejumula(OP)/2012/11, & Resisto (OP)/2012/2) were multiplied in the swamp and are ready for planting in farmers' fields	Delayed rains in some areas have caused delays in planting on-farm trials
Identify at least 2 new OSP for clean-up	Provide at least two new promising clones for clean up	SPK004/2006/1136 and NAS7/2006/292 that are to be released in 2013 were provided to CIP/Muguga for cleanup.	At least two more clones to be provided after the first verification trials
Establish in-vitro OSP stock	Establish a stock of virus-free plantlets of major OSP varieties at NaCRRI	A total of 59 in-vitro virus-free plantlets of NaSPOT 9 (Vita) and 32 of NASPOT 10 (Kabode) are available at the NaCRRI tissue culture lab.	Ejumula and Kakamega will be provided when ready
Workshops and meetings	Conduct workshops and meetings for farmer training	Activity to start during growing season	
Document experience and load results to Sweetpotato Knowledge Portal	Experience and any other relevant findings loaded onto the knowledge Portal	Complete reports were compiled for year 1	Data compilation is underway

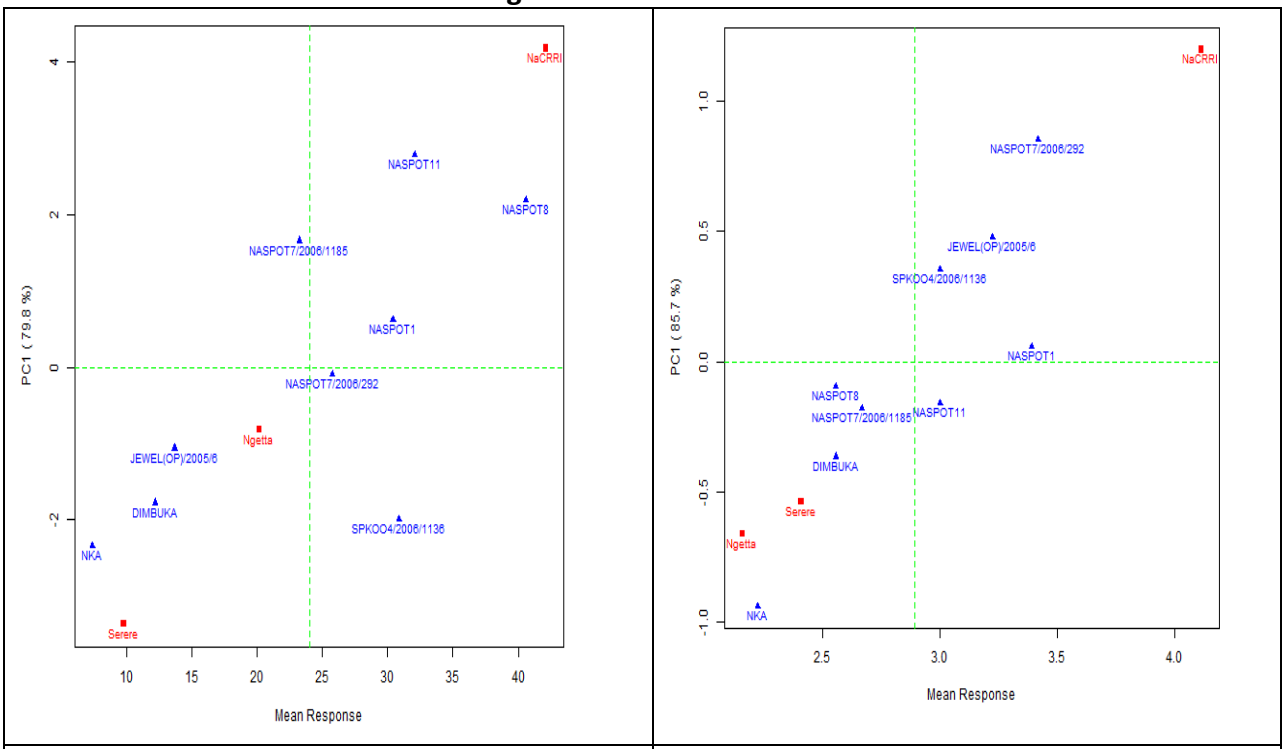
2.7 Harvesting of on-station trials

On station trials of OSP clones for the second season 2012 were harvested from only three locations, Namulonge, Ngetta, and Serere. The trial at Kabale did not establish well; data is

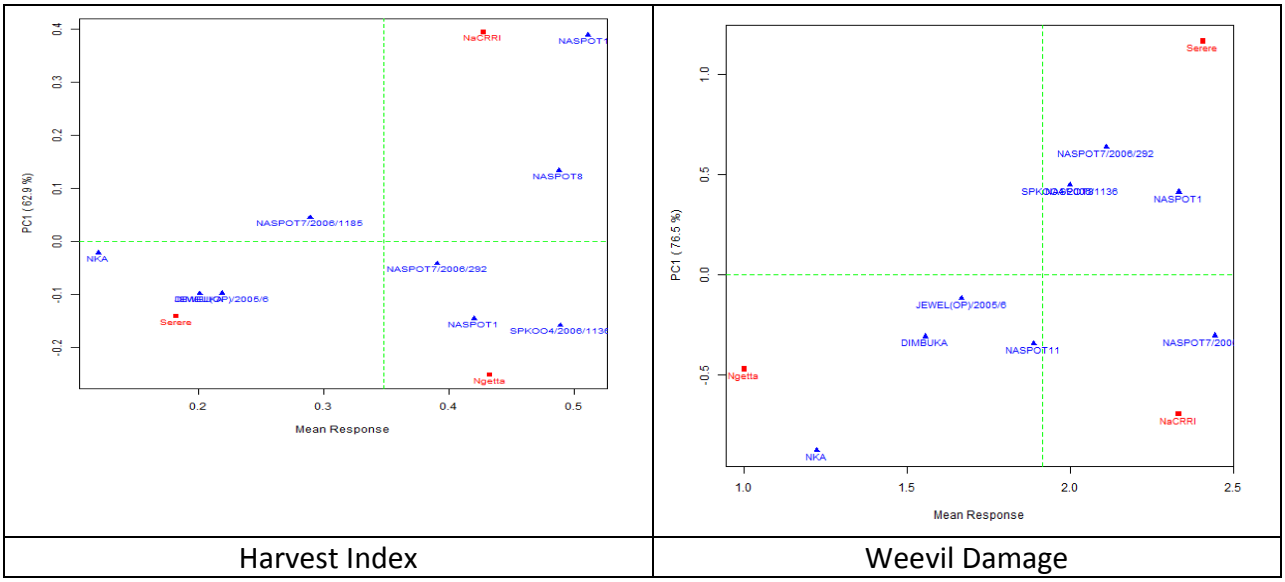
therefore not presented. Data for the other three sites is presented in Table 4, NASPOT 8, an OSP check variety yielded highest (40 t/ha). The farmers' preferred clones NAS7/2006/292 (25.8 t/ha), and SPKOO4/2006/1136 (30.9 t/ha) were comparable to the best Check clone, NASPOT 1 (30.4 t/ha) (Table 4). Combined analyses (Table 4) showed that Genotype (G), Environment (E) and G x E were highly significant for SPVD, total root yield, commercial yield and weevil damage. G x E was not significant for harvest index though G and E were significant. Additive main effects and multiplicative interaction (AMMI) analysis biplot (Figure 2) showed that the candidate clones had yields above the average of all clones tested (23 t/ha) (Fig. 1). NAS7/2006/292 was the most stable clone for root yield and the best environment for root yield was Ngetta. NASPOT 1 was most stable for SPVD reaction though NASPOT 8 had the lowest average SPVD score; NaCRRI location had the highest SPVD scores. During the season, Ngetta environment was very moist and this accounts for its lowest weevil damage. New Kawogo had the lowest weevil damage, though the scores for all clones did not exceed 3.0 (on a scale of 1-9).

Palatability tests including both OSP and non-OSP were conducted on-station. There were not great differences between the check (popular varieties like NASPOT 1) and the candidate varieties for release (NAS7/2006/292 and SPKOO4/2006/1136).

Figure 2. Biplots of mean root yield, SPVD, harvest index, and weevil damage and the first interaction principal components axis (PCA1) scores of OSP and 1 non-OSP clones grown in on-station trials in at 3 locations in Uganda



Root Yield	SPVD



Harvest Index | Weevil Damage

Table 4. Mean performance of 3 OSP, 1 yellow and 4 check clones evaluated at three on-station locations in Uganda, 2012 season 2

Genotype	Root yield (t/ha)	Mean harvest index	SPVD	Commercial yield	Flesh color	Weevil damage
JEWEL(OP)/2005/6 (yellow)	13.7	0.22	3.2	12.8	2	1.7
NASPOT7/2006/1185	23.3	0.29	2.7	22.2	8	2.4
NASPOT7/2006/292	25.8	0.39	3.4	24.5	8	2.1
SPKOO4/2006/1136	30.9	0.49	3.0	29.5	7	2
DIMBUKA (Non-OFSP Check)	12.2	0.2	2.6	10.5	2	1.6
NASPOT 1 (Non-OFSP Check)	30.4	0.42	3.4	29.4	2	2.3
NASPOT 11(Non-OFSP Check)	32.1	0.51	3.0	31.4	2	1.9
NKA (Non-OFSP Check)	7.4	0.12	2.2	7.4	2	1.2
NASPOT 8 (OFSP check)	40.6	0.49	2.6	39.7	6	2
Mean	**23.9**	**0.35**	**2.9**	**22.8**	**NA**	**1.9**
LSD	**5.9**	**0.08**	**0.5**	**5.9**	**NA**	**0.3**
CV	**30.1**	**27.95**	**19**	**31.3**	**NA**	**16.9**
Means by environment						
NaCRRI	42.1	0.43	4.1	41.4	**NA**	2.3
Ngetta	20.2	0.43	2.2	18.3	**NA**	1
Serere	9.8	0.18	2.4	9.4	**NA**	2.4
Mean	**24**	**3.79**	**2.9**	**22.8**	**NA**	**1.9**

SPVD=Sweetpotato virus disease severity, SPVD, weevil, and Alternaria damage scored on a scale of 1-9, where 1=no symptoms and 9=very severe damage symptoms. Fresh colour: 2-cream, 6- yellow with orange, 7- Pale orange, 8- Deep orange

NA = Not applicable

2.8 Transfer of the Triple S technology at scale and building a cadre of trained extension personnel to monitor its adoption

Sam Namanda conducted trainings on 'triple S' vine conservation and multiplication approach (February 7 – 15, 2013) for 4 pilot districts (Lira, Kole, Gulu and Oyam) in Northern Uganda (Photo G). Three main categories of field cadres participated including Community Resource persons (CRPs), Community Development Assistants/ field extension workers (FEWs) and farmers (Appendices –4-9). The trainings covered:

a) Background: review of importance of sweetpotato in household food and nutrition security
b) Importance of using the choice of sweetpotato roots for seed
c) Positive selection of clean and preferred sized seed roots
d) Timing of storage and method of storage
e) Establishment of irrigated root beds and agronomic practices

Three sites of root bed nurseries each in Lira, Kole, Oyam and Gulu districts were planted to validate the Triple S method to produce sweetpotato planting material for early season planting. Kakamega variety was planted at all sites and Kabode was only planted at 3 sites because of limited seed roots. A total of 85 community resource persons, 9 extension workers and 53 farmers were trained in application of the triple S method to produce sweetpotato planting material. A total of 37 females and 100 male participants were trained (See Table 5). Thirty farmers were selected to host demonstration sites for the Triple S demonstrations. A total of 123 Triple S Leaflets were provided to selected participants for reference. Follow up on trainings and monitoring on the progress of root beds is continuous. More reference material for host farmers are being prepared and will be provided.

Table 5. Summary of the categories of participants trained in Gulu, Oyam, Lira and Kole districts, and projected demonstration sites for season 2013A

District	Female participants			Male participants			Total participants	Total Demo sites
	*CRPs	*FEWs/CDAs	Farmers	CRPs	Fews	Farmers		
Gulu	11	1	12	15	1	2	42	11
Oyam	4	0	0	25	2	0	31	9
Lira	5	1	5	14	2	10	37	5
Kole	3	0	5	8	2	19	37	5
Total	23	2	22	62	7	31	147	30

Please refer to appendices 1 to 4 for details.

*CRPs = Community Resource Persons

*FEWs/CDAs = Field Extension Workers/Community Development Assistants

2.8.1 Results for on-farm validation of Triple S method of producing sweetpotato planting material in 4 districts in northern Uganda

Two sets of data were collected a) Using Kakamega variety to compare the differences in production of planting material under triple S and farmers' previous harvested fields and b) comparing Kakamega and Kabode varieties in producing planting material using the Triple S method variety at different sites. Under (a), 2 sites hosting the triple S trial and able to access a previous harvested field of Kakamega variety were randomly selected from each of the 3

research zones, namely Gulu, Oyam and Kole/Lira in northern Uganda. Fifteen growing root-shoots were randomly selected for assessment of the number of 30-cm long cuttings harvested at 45 days after planting the seed roots under watered beds. The study was conducted at least 3 weeks after the start of rains when the shoots from previous fields had also emerged and growing. The number of stems and branches on each root-shoot were counted and the total number of 30-cm long cuttings harvested or ready for harvesting from the stems and branches counted by respective farmer groups. The results obtained from either method were compared and appraisals made by farmers to understand the aim of the study. The cuttings from either source method were planted for production of ware sweetpotato. Under (b) the procedure in (a) was repeated for each root-shoot for each of the varieties Kabode and Kakamega for at least a site in each of the geographical locations. Note that Kabode treatment was limited so data under (a) did not include this variety. ANOVA was generated using the using GenStat Programme. At all sites the Triple S method significantly (P=<0.05) resulted into more numbers of cuttings produced per root-shoot than from previously harvested fields (See Table 6a and 6b) (Photos F, H, J, I, K, L, M, N). General differences in the number of cuttings across different sites were due to difference in the age of roots, storage period before sprouting. Okello had the lowest number of cuttings generated per root because the roots over sprouted and lost turbidity which resulted into more rotting of planted roots. Petwa had the highest average number of cuttings per root because of earlier planting compared to the rest of the sites, sufficient and regular watering at least once every week. Generally higher numbers of cuttings were harvested in Lira and Kole notably because the crop was 3 weeks older than the other sites in Gulu and Oyam.

Table 6a. Analysis of variance for average number of total 30-cm long cuttings harvested from shoots of 15 roots of Kakamega variety (orange sweetpotato) sampled from Triple S and Previous harvested farmers' fields

Source of variation	d.f.	s.s.	m.s.	v.r.	F pr.
Site	5	22270.1	4454.0	17.61	<.001
Source of cuttings	1	80518.0	80518.0	318.38	<.001
Site x source of cuttings	5	16096.8	3219.4	12.73	<.001
Residual	168	42486.5	252.9		
Total	**179**	**161371.5**			

Table 6b: Mean number of total 30-cm long cuttings harvested from shoots of roots of Kakamega variety (orange sweetpotato) sampled from Triple S and previous harvested farmers' fields (Each site = replication, each rep = 15 roots)

		Source of planting material		
District	**Site**	**Triple S**	**Previous harvested fields**	$Lsd_{0.05}$
Gulu	Acaye Margaret	39.7	2.9	8.11^{b}
Gulu	Okello	19.3	0.5	
Oyam	Akello Patrick	39.3	1.3	
Oyam	Renge	35.8	0.7	
Kole	Rose Akoi	44.9	0.8	
Lira	Petwa	86.7	5.7	
$Lsd_{0.05}$			4.68^{a}	

[a] Separation of means between sites , and [b]separation of means between sources of planting material

Table 7a: Analysis of variance for average number of total 30-cm long cuttings harvested from shoots of 15 roots each of Kakamega and Kabode varieties (orange sweetpotatoes) sampled from Triple S plots

Source of variation	d.f.	s.s.	m.s.	v.r.	F pr.
Site	2	27.0	13.5	0.05	0.947
Variety	1	13739.4	13739.4	55.66	<.001
Site x Variety	2	380.0	190.0	0.77	0.466
Residual	84	20733.5	246.8		
Total	**89**	**34879.8**			

The significant (P=<0.05) variety differences in numbers of 30-cm cuttings between Kakamega and Kabode were mainly due to the more wide spreading and branching growth habits of Kakamega than Kabode variety.

Table 7b: Average number of total 30-cm long cuttings harvested from shoots of Kakamega and Kabode varieties (orange sweetpotatoes) sampled from Triple S plots (Each site = replication, each rep = 15 roots)

Site	Variety		$Lsd_{0.05}$
	Kakamega	Kabode	
Acaye Margaret	39.7	17.1	**6.59**
Rosa Akoi	44.9	18.7	
Akello Patrick	39.3	18.2	

Tables 7a and 7b show that Kakamega significantly (P= <0.05) produced more average number of cuttings per planted seed root attributed to the differences in spreading growth habits. Notably the different maturity status of the roots and duration of storage also contributed to the different numbers of cuttings obtained. Kabode roots were sourced from Soroti and seemed harvested from a young crop due to due to limited availability of roots in the experimental sites. Generally Rosa Akol site in Kole district was planted much earlier than the other 2 sites and received more rains than the other sites which influenced more vigorous growth.

2.9 Exploratory snap study on assessing the gross margins of sweetpotato planting material produced under the Triple S method and previously harvested fields of Kakamega variety in Gulu district

Introduction

During the time of data collection, it was noted that sweetpotato planting material was being sold in Gulu town by street vendors. This prompted the interest to conduct a case study on determining the expected gross value of the planting material that was generated from the plots under triple S method of 15 seed lots using the existing market price. Since the average value of the number of cuttings had already been determined, samples of 10 bundles being sold were bought, cuttings counted and average number of cuttings established for the existing unit

price of UgSh. 500 (see Table 8). A case study was also conducted in Gulu to obtain an estimate of the relative value of the planting material harvested, 10 samples of bundles of planting material sold on the streets in Gulu were randomly selected and bought from the different vendors (sellers), and cuttings in each bundle counted. Although the price at which the material was retail and not farm gate it provided a realistic equivalent of the expected worth of the material harvested. Notably the price did not vary among the varieties and the bulkiness (stem thickness contributed to the fewer numbers of cuttings per bundle) of the cuttings that were being sold on the streets. Notably the size of bundles being sold was based on thickness and not numbers within the bundle resulting in different numbers of cuttings per bundle. Thus, the need to compute the average numbers for easy comparison.

Table 8: Samples of mini bundles of sweetpotato planting material sold on roadsides of Gulu town

Bundle unit	# of cuttings	Unit price	Comment
1	83	500	Tinny stems
2	50	500	Thick stems
3	35	500	Thick stems
4	65	500	Tinny stems
5	80	500	Tinny stems
6	62	500	Tinny stems
7	75	500	Tinny stems
8	60	500	Tinny stems
9	80	500	Tinny stems
10	60	500	Tinny stems
Average	65	500	

Table 8 shows that an average 65 vines were sold at UGSH. 500/= at open market price in Gulu.

Table 9: Extrapolation of gross benefits gained from irrigated seed root beds of roots sprouted roots from Triple "S" and farmers previous harvested fields in Gulu and Oyam districts

#		Irrigated seed roots (Triple S)			Previously harvested fields		
	Parameter	Acaye Margaret	Minakulu	Average	Acaye Margaret	Minakulu	Average
A	Total # of cuttings/15 roots	596	290	443	44	8	52
B	# of bundles = (A) # of cuttings/65	9	4	7	0	0	0
C	Unit sales price (UgSh.)	500	500	500	500	500	500
D	Gross sales (UgSh.)	4,500	2,000	3,500	0	0	0

*Sixty five number of cuttings used in (B) computation is generated from table 7 which is the average number of cuttings for UGSH 500 at open vine market in Gulu.

Table 8 shows that no selling of vines could be obtained from previously harvested fields within 3 weeks after the rains had started basically because most sprout shoots emerged after rains had started.

2.10 Season 2013A (April planting) demonstrations on using clean sweetpotato planting material

Clean planting material sourced from Biocrops (cycle 0) was planted second week of April in Mukono, Kamuli, Buyende and Rakai/Lyatonde with 3 sites in each district. Besides the Biocrops source, farmers in Kamuli had during the previous season of September 2012 planting received planting material from Biocrops. The material had been grown for a single season and then conserved by farmers in the wetlands for March/April 2013a season re-planting. This lot of vines referred to as cycle 1 was also sourced from the farmer Kamuli and re-planted during second week of April 2013 (2013a season) in the four districts already named to assess the trend of root yield decline. Thus, the trials on clean material in 2013a were planted with 2 objectives as summarized below and will be repeated in subsequent season.

1: To demonstrate the yield and disease performance of clean (Biocrops) and farmer own source of Ejumula (SPVD susceptible) and Kabode (SPVD resistant) planting material
2: Follow up the yield and disease performance of a series of generations of clean (Biocrops) of Ejumula (SPVD susceptible) and Kabode (SPVD resistant) planting material.

Table 10: Demonstration plan of clean against farmer planting material

On-farm planting season	# of sites	Source of material	Cycle of planting material
2013a	12	*Biocrops	0
(March/April planting)	12	On-farm (Kamuli)	1
2013b	12	*Biocrops	0
(July/August planting)	12	On-farm	1
	12	On-farm	2

* Only 3 successive lots will be sourced

In Table 10, demonstration plots each 36 m^2 or 36 mounds were planted using each of the 2 (Biocrops and Farmer own) sources of planting material of 2 (Ejumula and Kabode) varieties. Planting in Mukono, Kamuli, Buyende districts was done second week of April and Rakai/Lyatonde planted in mid-May.

Data collection

Data on visual symptoms of SPVD (scale of 1 – 9) is being recorded at one and two months after planting. Other data on marketable, unmarketable storage root yield and foliage weight will be taken at 100 – 120 days. The aim of the second objective is to follow up the performance 3 lots of clean planting material of Ejumula and Kabode varieties initially sourced from Biocrops (Generation 0) during successive seasons as indicated in Table 4 below. The follow of lot 1 started during September 2012B planting and lot 2 was first planted in April 2013A season. The third lot of material from Biocrops will be planted in July 2013A season. During subsequent year, trials will continue with only re-cycled material for the 3 different lots. During the July 2013A planting season, the last lot of material from Biocrops will be planted besides the continuing cycles of lots 1 and 2. At 75 days after planting (DAP) of the trial planted in April 2013A, vines will be sourced from the outer rows for re-cycling in July 2013b season at a total of 12 sites. The crop will be harvested at 100 – 120 days after planting.

Data collection

Pre-harvest data on sweetpotato virus disease (SPVD) incidence and severity is being recorded

at 4 and 8 weeks after planting. Biomass data will be taken at harvesting and will be analyzed using GenStat programme.

Table 11: Design of on-farm follow up study on performance of 3 lots of Biocrops material during successive seasons of planting

Month/ planting Season	Vines Lot 1	Vine Lot 2	Vines Lot 3
Sept 2012b	Biocrops (Cycle 0)		
April 2013a	Cycle 1	Biocrops (Cycle 0)	
July 2013b	Cycle 2	Cycle 1	Biocrops (Cycle 0)
2014			

NB: The assessment of re-cycled vines will continue during subsequent 2014 year

2.11 Tissue culture plantlet multiplication – MAK

In vitro plantlets of three OSP varieties are currently maintained at Makerere University Plant Tissue Culture Laboratory at Kabanyolo. A total of 100 in vitro plantlets of each variety, namely Ejumula, Kabode (SPK004/6/6) and Vita (SPK004/6) were received (see Table 12) from CIP-Nairobi. The in vitro plantlets are being sub-cultured onto multiplication medium, and later hardened and weaned in the screenhouse at Kabanyolo.

MAK is also maintaining three varieties (Ejumula, Kabode (SPK 004/6/6), and Vita (SPK 004/6) in the screenhouse at Kabanyolo. Screenhouse maintenance of Kakamega (SPK004) was put on hold following the suspicion and later testing positive to SPCSV. MAK delivered 10 and 20 in vitro plantlets of Kabode and Vita, respectively to NaCRRI for in vitro multiplication and maintenance. Under this new phase at least two other technicians from BIOCROPS will be trained in sweetpotato tissue culture techniques during August 2013.

Table 12. Progress by MAK

Planned Activities	Targeted outputs	Target Date	Baseline	Status	Comments
MAK Tasks					
In vitro multiplication and maintenance	100 in vitro plantlets of each variety.	50 bottles	20 bottles	50% (continuous activity)	50 bottles (of 2-3 plantlets) of each variety are being maintained. Sub-culturing is done at least once every 2 months. Plants have already been established in the screenhouse for further multiplication. MAK will continue delivery to BIOCROPS.
Training	4 persons	December 2013	2	50%	Another 2 BIOCROPS technicians will be trained during August 2013 in sterilization of sweetpotato explants, initiation and serial culture of auxiliary buds.
Assess the cost of TC multiplication in Uganda	1 report	November 2013	0	25%	We are still collecting data.

2.12 Vine multiplication at BioCrops

BioCrops and CIP entered into an understanding in 2012 to establish a sustainable supply of virus-free vines of four orange flesh sweetpotatoes varieties; Ejumula, Kabode, Kakamega and Vita. This project was extended to the second year ending 31st December 2013 where BioCrops was contracted to multiply and supply forty thousand cuttings of virus free primary foundation material of three orange flesh sweetpotatoes (OFSP) varieties; Ejumula, Kabode and Vita. Variety Kakamega was discontinued as it was found not to be clean. BioCrops was allocated $6,000 for this year to implement the activities towards this objective and $4,000 was received on 17th May 2013.

Table 13.Summary of status of the activities for BioCrops from March to 15 June 2013

Activity/Milestone	Targeted output	Target date	Baseline	Status	Comment
Supply of clean vines maintained	40,000 virus free vines	31 December 2013	6000 vines were delivered up to March 2013: Ejumula = 2,000 Kabode = 2,000 Vita = 2,000	80% delivery achieved.	Total of 32,000 vines have been delivered since beginning of 2013: Ejumula = 13,000 Kabode = 11,000 Vita = 8,000
***In vitro* cultures of indexed sweetpotatoes established**	Have at least 100 in vitro cultures of Ejumula, Kabode and Vita and at least two other farmer preferred varieties	By end of July 2013	Shelves for the growth room to be used for sweetpotatoes were installed	Ten cultures of Kabode were received from MAK. Complete lighting will be done when the mains electricity becomes stable to run the lighting and cooling system of the growth room.	A three phase line has been laid up to BioCrops. An application has been made to UMEME to upgrade the electricity supply to a commercial/ industrial level (3 phase). More cultures will be received from MAK once reliable electricity is in place.
BioCrops staff trained by MAK in tissue culture of sweetpotato	4 staff trained	First week August 2013	Two staff trained by MAK in 2012 in sweet potato tissue culture and screenhouse propagation.	One trained staff is in charge of screenhouse multiplication. The second person is handling tissue culture on a small scale as electricity is sorted out.	50% training has been accomplished.

Photos

A

B

C

D

E

F

G

H

I

J

K

L

M

N

A: Roots of OSP clone NASPOT 7/2006/ 292, B: Roots of OSP clone SPK 004/2006/1136
C: One of the gardens planted for post-harvest experiments
D: Cooked roots displayed during a palatability test at Rakai (A: NASPOT 10, B: NASPOT 7/2006/1185, C: SPK 004/2006/1136, D: NASPOT 7/2006/292, D: farmers' local variety)
E: One of the Field Extension Workers participates in planting of on-farm trials in Isingiro
F: Triple S vigorously growing shoots
G: Farmers preparing roots for storage Triple S training in Gulu district
H: Previous harvested fields' root-shoots
I: Counting # of stems and cuttings per root-shoot
J: Observations and experiences sharing on Triple S method
K: Identifying root shots in previous field
L: Root shoots destroyed by mole rats especially in previous fields due to dense bush around and weeds within the field
M: Kabode Triple S shoots 45 days after planting
N: Kakamega Triple S shots 45 days after planting

3.0 Summary of personnel commitments

Dr. Robert Mwanga and Mr. Gerald Kyalo have continued to serve as Principal Investigator and Field Crops Agronomist for the project, respectively. Our partners, NaCRRI, Makerere University and BioCrops also continued with their activities as stipulated in their contracts. At NaCRRI, one Scientist (10% time), 1 technician (50%) and 1 driver (30%) are involved in the project. At Makerere, Dr. Ssetumba Mukasa has two technicians who are committed to the project.

4.0 Major equipment acquired

None.

5.0 Description of significant travel

During the reporting period, CIP staff undertook travels to accomplish project objectives. Table 14 below summarizes the travels.

6.0 Delays, Problems, Suggestions

The planned project activities are on course. Planting 1st season OSP trials 2013 was delayed due to shortage of planting materials and prolonged drought in some areas. But it was successfully done. Renewal of the contracts for project partners delayed, leading to late release of funds.

Table 14. Summary of significant travels

Date	Name	Institution	Locations	Travel objective	Output
14-25.012013	Gerald Kyalo Jowelia Namakula	CIP NaCRRI	Buyende, Oyam	Harvesting 2nd season OSP trials	17 OSP trials harvested, 3 palatability assesments done.
21-23. 02.2013	Gerald Kyalo Joweria Namakula	CIP NaCRRI	Rakai, Masaka	Selecting farmers to host curing, storage, harvesting 4 OSP trials	Two farmers identified per district, 4 OSP trials harvested, 1 palatability assessment done
11-21. 02.13	Gerald Kyalo Jowelia Namakula	CIP NaCRRI	Kabale, Isingiro	Assesemnt of SPVD, Alternaria blight, vigour and monitoring OSP trials	Diseases and vigour assessed, status of OSP trials established
18-20.02. 2013	Gerald Kyalo	CIP	NaCRRI	Participating in CloneSelector refresher training conducted by Luka Wanjohi and Robert Mwanga.	On-farm trial data was analyzed in CloneSelector
6.03. 2013	Robert Mwanga	CIP	FARM RADIO International (FRI), Kampala	To identify specific priorities related to OFSP for consideration with FRI Uganda office, discuss the TOR for the OFSP National Advisory Group (NAG) and elect a chairperson of the group.	Priorities related to OSP consideration with FRI identified, Robert Mwanga elected chairperson NAG.
7-15.2.13	Sam Namanda	CIP	Lira, Gulu, Kole, Oyam	Trainings on 'triple S' vine	A total of 37 females and 100 male

				conservation and multiplication approach	participants trained, 30 demonstrations set up with farmers
23-29. 3.13	Sam Namanda	CIP	Lira, Oyam, Kole, Gulu	Follow up and monitoring Triple S activities	Status of Triple S demonstrations established, preparations for planting on beds started
28.3-2.4.13	Gerald Kyalo	CIP	Masaka, Rakai, Mukono	Preparing for planting of materials for post-harvest experiments.	Preparations done, land preparations in progress.
8-13. 4. 13	Sam Namanda Joweria Namakula	CIP (NaCRRI)	Isingiro	Harvesting 2nd season 2012 OSP trials	7 trials harvested, 2 palatability tests conducted
9-20.4 13	Gerald Kyalo	CIP	Soroti, Masaka, Mukono, Rakai	Planting materials for post-harvest Experiments	2 farmers planted per district with 1.5 acres of gardens each
22.4-3.5.13	Gerald Kyalo Joweria Namakula	CIP (NaCRRI)	Rakai, Kabale	Harvesting 2nd season OSP trials	17 trials harvested, 3 palatability tests conducted.
24-26.04.2013	Sam Namanda	CIP	Mukono, Kamuli, Buyende	Planting trials of clean Vs farmers materials	2 trials planted per district
7-9.05.2013	Sam Namanda	CIP	Rakai	Planting trials of clean Vs farmers materials	3 trials planted
23-28.5.13	Gerald Kyalo	CIP	Rakai, Masaka, Soroti, Mukono	Monitoring materials for post-harvest experiments	2 gardens monitored per district. 1st weeding of all gardens done.
24.5-2.6.13	Namanda Sam	CIP	Gulu, Oyam, Lira, Kole	Collecting data on Triple S actvitites	Data collected, analysed and documented.
13-15. 6. 13	Sam Namanda	CIP	Mukono, Kamuli, Buyende	Pre-harvest assessment of trials	Data collected on establishment, vigor, SPVD, and alternaria.
11-19.6.13	Gerald Kyalo Joweria Namakula	CIP (NaCRRI)	Isingiro, Kabale, Rakai, Buyende, Oyam	Planting 1st season OSP trials.	5 trials planted (1 per district)

Appendix 1: Progress on Objectives and Outcomes for CIP

Milestone	Targeted outputs	Baseline	Progress/ Status	Comments
Objective 1:	**Ensure disease-free supply of primary foundation seed**			
Provide training, and ensure that the private sector partner can produce quality primary material using plantlets from MAK, initially obtained from KEPHIS, Muguga, Kenya.	40,000 cuttings of primary material produced	Required pathogen-tested in vitro OSP varieties not available at MAK	A total of 32,000 vines delivered by BioCropssince January 2013. 1. Ejumula = 13,000 2. Kabode = 11,000 3. Vita = 8,000 80 % delivery achieved.	Activity is on schedule
Asses the cost of tissue culture multiplication in Uganda.	Capacity of Biocrops to multiply clean foundation planting material established, two vine multipliers identified per district and trained on vine multiplication techniques	No experience of multiplying pathogen-tested OSP vines	Seven vine multipliers visited BioCrops on 10th December 2012 and were taken through the tissue culture procedure of generating virus free shoots and how the clean status in maintained in the insect proof nets/screen houses and on farm. They were also trained in weaning and nursery management.	Tracking of costs at BioCrops is on-going
Objective 2:	**Transfer the Triple S technology at scale and build a cadre of trained extension personnel to monitor its adoption**			
Select key dry areas for testing this technology at scale.	Triple S technology validated and scaled up with farmers in key dry areas, 30% of target households in areas with prolonged dry seasons adopt the technology	Triple S technology not yet tested in HarvestPlus project areas	A total of 30 demonstrations were set up in Feb on Triple S in Gulu, Oyam, Kole and Lira districts. 100 % completed	Selected farmers have been trained and are hosting demonstrations.
Train extension personnel to effectively implement the technology.	At least one lead farmer from each county hosting OSP trials trained in OSP production	No extension personnel trained in OSP production	137 farmers, Field Extension workers/ Community Development Assistants trained in Gulu, Oyam, Kole and Lira districts 50 % completed	Training will continue as new sub counties are identified.
Monitor adoption of	At least 30% of communities in	OSP is not grown in	Not done	Activity planned for later

technology and make any needed changes in approach based on addressing any emergent constraints to adoption.	project areas adopt Triple S.	the project areas		years
Evaluate characteristics of adopters and non-adopters.	Percent adoption and characteristics of adopters	Technology absent in project area	Not done	Activity planned for later years
Objective 3:	**Accelerate evaluation of on-farm of promising OSP clones**			
Conduct on-farm trials with extensive farmer participation in key target areas.	New OSP clones evaluated with farmers and at least two clones selected for further evaluation	New OSP clones from NaCRRI have not been tested in HarvestPlus project areas	Harvesting of 2nd season 2012 trials has been done in Buyende, Rakai, Isingiro, Kabale and Oyam districts. 1st season OSP trials for 2013 have been planted with OSP clones Ejumula (OP) 2012/ 3, Ejumula (OP) 2012/ 11, Ejumula (OP) 2012/ 9, Ejumula (OP) 2012/ 10 and Resisto (OP) 2012/ 1. A total of 5 trials were planted (1 per district) Activity is on schedule	Planting was delayed due to shortage of planting material and unfavorable weather.
Provide at least two new clones for cleanup for the seed system by year 4	Promising clones cleaned up before they are provided to vine multipliers and farmers	New clones from NaCRRI not yet cleaned	Promising clones SPK 004/2006/1136 and NASPOT 7/2006/292 have already been sent to KEPHIS, Kenya, for cleaning.	Promising clones will be cleaned as and when they come up
Objective 4:	**Improve curing techniques and investigate other ways to improve post-harvest quality and extend post-harvest shelf life of traded OSP**			
Design and conduct trials and curing demonstrations	Conditions for curing established	There is no curing of OSP in E. Africa	Farmers (7) to host curing experiments have been identified in Mukono (2), Rakai (2), Soroti (1) and Masaka (2). Planting of materials for post-harvest experiments has been	1st weeding of the gardens has been done

			done. Varieties of sweetpotato planted include Kabode, NASPOT 8, NASPOT 1 and local variety SOCADIDO. 50 % completed.	
Evaluation of improved curing methods vs. current practice	Improved curing and storage techniques tested with farmers	Limited shelf life of sweetpotatoes	Curing experiments will be set up in August 2013 and will run for 3 months	Activity planned for August 2013.
Work with implementation team to improve training on handling of roots during harvest and postharvest.			Trainings on post-harvest handling will be scheduled at harvesting time	
Objective 5:	**Backstop Implementation Team and Broader Dissemination Objectives**			
Respond to emergent problems concerning sweetpotato multiplication and production as requested by the implementation team.	Emerging problems solved	Issues among partners vary	CIP staff backstop HarvestPlus team on training of farmers, extension personnel and vine multipliers	
Ensure that experience is documented and any relevant materials and finding are loaded on the Sweetpotato Knowledge Portal.	Documented experiences	No experiences on new OSP varieties and Triple S in HarvestPlus project areas	Quarterly and final 2012 technical reports have been written	

Appendix 2: Progress on Objectives and outcomes for NaCRRI

Milestone	Targeted out puts	Baseline	Progress
Objective:	**Accelerate evaluation on-farm of promising OFSP clones**		
Conduct on-farm trials with extensive farmer participation in key target areas.	New OFSP clones evaluated with farmers and at least two clones passed on to the farmers	New OFSP clones from NaCRRI have been tested on-station.	Two famer choice clones, SPK 004 2006/1136 and NAS7/2006/292 selected from previous on-farm trials during 2011/2012 have been established for distinctness, uniformity and stability (DUS) tests. The clones are also maintained in the swamp and screen house and have been sent to Muguga, Kenya for virus clean-up. Also, 4 new promising clones (Ejumula OP/ 2012/9, Ejumula OP/2012/10, Ejumula OP/ 2012/11, Resisto OP/2012/2, have been planted in on-farm trials for evaluation.
Objective:	**Backstop Implementation Team and Broader Dissemination Objectives**		
Respond to emergent problems concerning sweetpotato multiplication and production as requested by the implementation team.	Provide solutions to urgent problems	No research institution ready to backstop partners consistently	NaCRRI team backstops partners as need arises
Ensure that experience is documented and any relevant materials and finding are loaded on the Sweetpotato Knowledge Portal.	Documented information is readily available	Information on OSP in target districts lacking	Quarterly and final 2012 technical reports have been written

Appendix 3: Progress on Objectives and Outcomes for MAK and BioCrops

Milestone	Targeted out puts	Baseline	Progress
Objective :	**Ensure disease-free supply of primary foundation seed**		
Provide training, and ensure that the private sector partner can produce quality primary material using plantlets from MAK, initially obtained from KEPHIS, Muguga, Kenya	40,000 cuttings of primary material produced by BioCrops	BioCrops has clean OSP from MAK	A total of 32,000 vines delivered by BioCrops since January 2013. 2. Ejumula = 13,000 4. Kabode = 11,000 5. Vita = 8,000 80 % delivery achieved MAK is maintaining 50 bottles (of 2-3 plantlets) of each variety. Sub-culturing is done at least once every 2 months. Plants have already been established in the screenhouse for further multiplication. MAK will continue delivery to BIOCROPS.
Asses the cost of tissue culture multiplication in Uganda	Capacity of Biocrops to multiply clean foundation planting material established	No experience with OSP multiplication	Tracking of costs at BioCrops is on-going

Appendix 4: list of participants from Gulu district sensitized and trained in Triple S method of producing sweetpotato planting material. CRPs = Community Resource Persons, FEWs-Field Extension Workers, CDAs-Community Development Assistants

#	Name of farmer	Sex	Sub county	Parish	Status of participant			
					CRP	CDA/FEW	Farmer	Demo Host
1	Betty Anek Otim	F	Bobi	Paidwe	1	0	0	1
2	Betty Oroma	F	Bobi	Paidwe	1	0	0	0
3	Stella Akajo	F	Bobi	Paidwe	1	0	0	0
4	Lilly Okulu	F	Bobi	Palwo	1	0	0	0
5	Romano Okello	M	Bobi	Palwo	1	0	0	0
6	Winfred Okot	M	Bobi	Paidwe	1	0	0	0
7	Charles Acaye	M	Bobi	Paidwe	1	0	0	0
8	Santo Okoya	M	Bobi	Paidwe	1	0	0	1
9	Gaudensio Okello	M	Bobi	Paidwe	1	0	0	1
10	Felix Otiti	M	Bobi	Paidwe	1	0	0	1
11	Tony Abic	M	Bobi	Paidwe	1	0	0	0
12	Mariano Ojok	M	Bobi	Paidwe	1	0	0	0
13	Marino Atim	M	Bobi	Palwo	1	0	0	0
14	Alfonse Woo	M	Bobi	Palwo	1	0	0	0
15	Alex Omara	M	Bobi	Paidwe	0	1	0	0
16	Richard Obura	M	Bobi	Paidwe	1	0	0	1
17	Geoffrey Okenya	M	Bobi	Palwo	1	0	0	0
18	Micheal Ocen	M	Bobi	Palwo	1	0	0	1
19	Walter Ocan	M	Koro	Acoyo	1	0	0	0
20	Agnes Auma	F	Koro	Acoyo	0	0	1	0
21	Harriet Akello	F	Koro	Acoyo	0	0	1	0
22	Franka Lakot	F	Koro	Acoyo	1	0	0	0
23	Haron Akello	F	Koro	Acoyo	0	0	1	0
24	Saritha Alanyo	F	Koro	Acoyo	1	0	0	1
25	Alice Oroma	F	Koro	Acoyo	0	0	1	1
26	Laker Kevine	F	Koro	Acoyo	0	0	1	0
27	Anna Ayol	F	Koro	Acoyo	0	0	1	0
28	Margaret Acaye	F	Koro	Acoyo	1	0	0	1
29	Beatrice Acen	F	Koro	Acoyo	0	0	1	0
30	Richard Odong	M	Koro	Acoyo	1	0	0	0
31	Lucy lakot	F	Koro	Acoyo	0	0	1	0
32	Beatrice Auma	F	Koro	Acoyo	0	0	1	0
33	Filda lanyero	F	Koro	Acoyo	0	0	1	0
34	Isaac Ojok	M	Koro	Ibakara	0	0	1	0
35	Susan Apiyo	F	Koro	Ibakara	0	0	1	0
36	Denisi okello	M	Koro	Ibakara	1	0	0	0
37	Jimmy Odongo	M	Koro	Ibakara	0	0	1	0

38	Richard Ojok	M	Koro	Ibakara	1	0	0	1
39	Jovin Okello	M	Koro	Ibakara	0	0	1	0
40	Simon Peter Opiyo	M	Koro	Ibakara	1	0	0	0
41	Everly Otika	M	Koro	Ibakara	1	0	0	1
42	Aber Stella	F			0	1	0	0
				Total	**26**	**2**	**14**	**11**

Appendix5: list of participants from Oyam district sensitised and trained in Triple S method of producing sweetpotato planting material. CRPs = Community Resource Persons, FEWs-Field Extension Workers, CDAs-Community Development Assistants

#	Name of farmer	Sex	Sub county	Parish	Status of participant		
					CRP	**CDA/FEW**	**Host**
1	Richard Obong	M	Minakulu	Atek	1	0	1
2	Tonny Amai	M	Minakulu	Atek	1	0	1
3	Samuel Otodi	M	Minakulu	Atek	1	0	0
4	Bonny Omara	M	Minakulu	Atek	1	0	0
5	Richard Ogola	M	Minakulu	Atek	1	0	1
6	Lawrence Ongom	M	Minakulu	Opuk	1	0	0
7	Bosco Odongo	M	Minakulu	Opuk	1	0	0
8	Agnes Ongom	F	Minakulu	Opuk	1	0	1
9	Annet Opio	F	Minakulu	Atek	1	0	0
10	David Abor	M	Minakulu	Atek	1	0	0
11	Densh Apunyu	M	Ngai	Acut	1	0	0
12	Patrick Ayu	M	Ngai	Omac	1	0	1
13	Beatrice Ojuk	F	Ngai	Omac	1	0	0
14	Richard Akaki	M	Ngai	Omac	1	0	0
15	Calvin Odongo	M	Ngai	Omac	1	0	0
16	Maxwel Nam	M	Ngai	Acut	1	0	1
17	Patrick Oyile	M	Ngai	Acut	1	0	0
18	Lawrence Ocan	M	Ngai	Acut	1	0	0
19	Dicken Okello	M	Ngai	Acut	1	0	0
20	Robert okello	M	Ngai	Omac	1	0	1
21	Walter Ekuba	M	Ngai	Acut	1	0	0
22	Michael Opio	M	Ngai	Acut	1	0	0
23	Aldo Ocen	M	Ngai	Acut	1	0	0
24	Santo Okello	M	Ngai	Acut	1	0	1
25	Francis Opio	M	Ngai	Omac	1	0	0
26	Hahab Renuls	M	Ngai	Omac	1	0	**0**
27	Grace Ekanya	F	Ngai	Omac	1	0	0
28	Ray Okello	M	Ngai	Acut	1	0	0
29	Patrick Okello	M	Ngai	Omac	1	0	1
30	Patrick Aluku	M			0	1	0

31	Oyena Emmy	M		0	1	0
			Total	**29**	**2**	**9**

Appendix 6: list of participants from Lira district sensitised and trained in Triple S method of producing sweetpotato planting material. CRPs = Community Resource Persons, FEWs-Field Extension Workers, CDAs-Community Development Assistants

#	Name of farmer	Sex	Sub county	Status of participant			
				CRP	**CDA/FEW**	**Farmer**	**Host**
1	Stephen Odongo Leo	M	Aboke	0	1	0	0
2	Lamex Dongo	M	Barr	1	0	0	1
3	Geoffrey Otim	M	Barr	1	0	0	0
4	Tonny Amai	M	Barr	1	0	0	0
5	Alfred Otim	M	Barr	1	0	0	0
7	Alfred Olila	M	Barr	1	0	0	1
28	George Ogwang	M	Barr	0	0	1	0
29	Junira Ocen	M	Barr	0	0	1	0
30	Joe Olinga	M	Barr	1	0	0	0
31	Moses Ajula	M	Barr	1	0	0	0
32	Vincent Okeng	M	Barr	0	0	1	0
33	Moses ogwang	M	Barr	0	0	1	1
6	George Obong	M	Ngetta	1	0	0	0
8	William Opio	M	Ngetta	1	0	0	0
9	Patrick George Ojok	M	Ngetta	1	0	0	0
10	Tom Aguma	M	Ngetta	1	0	0	0
11	Tonny Omara	M	Ngetta	0	0	1	0
12	Bonifance Keny	M	Ngetta	0	0	1	0
13	Janan Okello	M	Ngetta	1	0	0	0
14	Tonny Okello	M	Ngetta	1	0	0	0
15	David Agoro	M	Ngetta	1	0	0	0
16	Patrick Opolo	M	Ngetta	0	0	1	0
17	Jasper Ayo	M	Ngetta	0	0	1	0
18	Monica Kibuka	F	Ngetta	1	0	0	0
19	Harriet Okaka	F	Ngetta	1	0	0	0
20	Teddy Opio	F	Ngetta	1	0	0	0
21	Grace Omara	F	Ngetta	1	0	0	0
22	Susan Okello	F	Ngetta	0	0	1	1
23	Milly Omara	F	Ngetta	1	0	0	0
24	Perpetua Okolo	F	Ngetta	0	0	1	0
25	Jasper okello	M	Ngetta	0	0	1	0
26	Betty Rose Aceru	F	Ngetta	**0**	0	**1**	0
27	David Odwar	M	Ngetta	0	1	1	0

34	Hellen Grace Akullu	F	Ngetta	0	1	1	1
35	Doreen Ayuru	F	Ngetta	0	0	1	0
			Total	**19**	**3**	**15**	**5**

Appendix 7: list of participants from Kole district sensitised and trained in Triple S method of producing sweetpotato planting material. CRPs = Community Resource Persons, FEWs-Field Extension Workers, CDAs-Community Development Assistants

#	Name of farmer	Sex	Status of participant			
			CRP	CDA/FEW	Farmer	Host
1	Mario Okullu	M	1	0	0	0
2	Fred Munu	M	1	0	0	0
3	Jimmy Awady	M	0	0	1	0
4	Denish Okello	M	0	0	1	1
5	George Apoka	M	0	0	1	0
6	Monica Alupu	F	1	0	0	0
7	Florance Omara	F	1	0	0	0
8	Miriam Oduca	F	0	0	1	0
9	Simpo Akullu	F	0	0	1	1
10	Silvia Awidi	F	0	0	1	0
11	Anna Ogwang	F	0	0	1	0
12	Kenneth Acuti	M	1	0	0	0
13	Lawrence Omony	M	1	0	0	0
14	Geoffrey Okabo	M	0	0	1	0
15	Tobia odongo	M	0	0	1	0
16	Vincent Alobo	M	1	0	0	1
17	George Akenya	M	0	0	1	0
18	Peter Silivesto Obong	M	0	0	1	0
19	Geoffrey Okello	M	0	0	1	0
20	Tom Opio	M	0	0	1	0
21	Alfred Ojok	M	0	0	1	0
22	Sam Okello	M	0	0	1	0
23	Samuel Ojok	M	0	0	1	0
24	Charles Oyar	M	0	0	1	0
25	Benard Oming	M	1	0	0	0
26	Milton Obong	M	0	0	1	0
27	Rose Akoi	F	1	0	0	0
28	Monica Akullu	F	0	0	1	0
29	Tom Ayo	M	1	0	0	0
30	Jacob Aripa	M	1	0	0	1
31	Fred Amot	M	0	0	1	0
32	Tonny Agulu	M	0	0	1	0
33	Cyprano Oyel	M	0	0	1	0

34	Denish Ayo	M	0	0	1	1
35	Charles Okidi	M	0	0	1	0
36	Robert Okello	M	0	1	0	0
37	Geoffrey Ocuku	M	0	1	0	0
		Total	**11**	**2**	**24**	**5**