



# **Rooting Out Hunger in Malawi with Nutritious Orange-Fleshed Sweetpotato**

**Year 3 Annual Report  
1<sup>st</sup> November 2011–31<sup>st</sup> October 2012**

*Prepared for:*  
Irish Aid

*Submitted by:*  
International Potato Center (CIP)

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*Members of Michisi Club, Phalombe District. The club, comprising mainly of People Living with HIV and AIDS, has become a successful OFSP vine multiplier. The picture is in front of a club member's new house financed from her OFSP earnings.*

**Submitted by:  
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## ABBREVIATIONS AND ACRONYMS

ASWAp	Agriculture Sector-wide Approach
CAADP	Comprehensive Africa Agriculture Development Programme
CADECOM	Catholic Development Commission
CIP	International Potato Center
CV	Coefficient Variation
CU	Concern Universal
DARS	Department of Agriculture Research Services
DAES	Department of Agriculture Extension Services
DVMs	Decentralized Vine Multiplications
FAO	Food and Agriculture Organization
FEWS	Famine Early Warning Systems
FEWSNET	Famine Early Warning Systems Network
FGDs	Focal Group Discussions
FUM	Farmers Union of Malawi
HH	Household
IEC	Information Education and Communication
IPs	Implementing Partners
LER	Land Equivalent Ratio
LSD	Least Significant Difference
MAP	Month after Planting
MDG	Millennium Development Goal
M&E	Monitor and Evaluation
Mk	Malawian Kwacha
MoAFS	Ministry of Agriculture and Food Security
MTR	Midterm Review
mt/ha	metric tons/hectare
MVP	Millennium Villages Project
NASFAM	National Smallholder Farmers Association of Malawi
NGO	Non-Governmental Organization
OFSP	Orange-fleshed sweetpotato
PQS	Plant Quarantine Services
SUN	Scaling up Nutrition
T-1, -2 ... 4	Treatment – 1, -2 ... -4
UIL	Universal Industries Ltd.
UN	United Nation
WALA	Wellness and Agriculture for Live Advancement
WFP	World Food Programme

## EXECUTIVE SUMMARY

The *Rooting Out Hunger in Malawi with Nutritious Orange-fleshed Sweetpotato* Project is a 4.5-year, multi-partner effort to improve vitamin A and energy intake among at least 70,000 households with young children (the group most vulnerable to vitamin A deficiency) by expanding OFSP production and consumption in four target districts. The project is closely aligned with, and has made important contributions to, Malawi's main agricultural and nutrition strategies, namely the Agriculture Sector-wide Approach (ASWAp), the national Comprehensive Africa Agriculture Development Programme (CAADP) Investment Framework, and the national priorities of Scaling-Up Nutrition (SUN) initiative.

During the Reporting Period, the Project has made further strong progress in reaching the target numbers. In the rainy season of 2011/2012, 23,935 beneficiaries grew OFSP on a total area of 161.6 ha, more than doubling the figures from the previous year (10,968 beneficiaries on 73.4 ha). Preparations for the coming 2012/2013 rainy season indicate that over 27,000 households (HHs) have already been registered to receive subsidized vine vouchers, while more beneficiaries will be reached through local vine marketing and additional development programs that have started to procure quality OFSP vines from project partners and to distribute these in a larger number of districts. This expansion of OFSP production beyond the initial voucher scheme and target districts will continue a trend already observed during the past year, and the project will closely assess and document this positive development.

The project continued its maize and sweetpotato intercropping trials started in Year 2, thus covering two rainy seasons, i.e. 2010/11 and 2011/12. The objective of this on-station research was to determine what potential benefits farmers could derive from intercropping maize and sweetpotato. The trials included six treatments with different combinations and ratios for the two crops. The Land Equivalent Ratio (LER) of 1.79, used to determine efficiency of intercropping, indicated that intercropping of maize and sweetpotato provides a viable option for increasing farm productivity. Gross margin analyses further show that intercropping is a profitable strategy, with most of the profits coming from sweetpotato. In addition, sweetpotato weevil infestation, a major constraint to production, was reduced in plots with maize intercropping or border-cropping, confirming similar research results elsewhere in the region (Nampeera et al 2011, Uganda). Finally, farmer perceptions of intercropping were documented and show a preference of intercropping over mono-cropping at this stage, though sample size and time-frame were quite limited. Taken together, the trial results justify and help guide follow-up on-farm adaptive research that maximizes benefits from intercropping maize and sweetpotato, and other crop combinations (such as soy bean, which is of great interest to farmers). The project will continue to pursue this development path and produce guidelines and training materials for scaling-out successful intercropping options.

A second line of adaptive research that began in Year 3 was the comparison of the performance of two sets of Zondeni OFSP planting materials, (i) clean material obtained from Plant Quarantine Services (PQS) in Nairobi and (ii) material generated through positive selection locally, in an effort to determine variance between the sets. Trials were carried out in Phalombe and Thyolo districts, and so far, the results from these two replicates indicate an insignificant difference between the PQS and positive selection materials, with respect to weight of marketable roots and total root yield. In order to draw conclusions, however, the trials will need to be continued for the 2012/13 rainy season.

Through systematic monitoring of the project's impact, a production survey and market assessments was conducted in Dedza, Zomba, Phalombe and Chikhwawa in October 2012. Amongst the main findings were that OFSP is contributing to improving the overall sweetpotato yields in the targeted districts, due to the use of high-yielding clean OFSP Zondeni planting material from positive selection and the increased land allocation to the crop among the beneficiaries and DVMS. Consequently, OFSP has improved food availability at the household level, and is used to substitute maize in daily meals, thus prolonging the availability of maize flour into the lean season. OFSP has further brought new business opportunities for women in the target areas and women feel more empowered in decision making at household level. Similarly, the project has improved social capital among rural women, because they are benefitting from information and experience sharing through their membership in OFSP clubs.

The project's implementing partners continued to demonstrate strong commitment to project objectives and activities. Their Progress Reports are annexed to this Technical Report. The project's partnership approach has been validated for the diffusion of knowledge and mass distribution of OFSP, and the project will continue its capacity strengthening support in preparation for wider scaling-out.

## 1. INTRODUCTION

The *Rooting Out Hunger in Malawi with Nutritious Orange-fleshed Sweetpotato* project is a 4.5-year, multi-partner effort to improve vitamin A and energy intake among at least 70,000 households with young children (the group most vulnerable to vitamin A deficiency) by expanding OFSP production and consumption in four target districts. The project is closely aligned to Malawi's Agriculture Sector-wide Approach (ASWAp), and supports the achievement of the national Comprehensive Africa Agriculture Development Programme (CAADP) goals (Malawi Government 2010). Table 1 below summarizes the project's specific contributions to ASWAp Strategic Objectives. Overall, the project's main contributions are in the areas of strengthening nutrition security and awareness, expanding sweetpotato production, improving land management and strengthening institutional and productive capacity. With respect to the wider CAADP agenda, the project helps strengthen national research-for-development capacity and knowledge dissemination (Pillar IV) and enhances food and nutrition security (Pillar II). In doing so, the project furthers Malawi's progress towards achieving the Millennium Development Goals (MDGs), in particular in the areas of nutrition and health, education, gender, environment, and governance (MoAFS 2008). Based on the recognized value of OFSP in meeting Scaling-Up Nutrition (SUN) initiative goals, the project was actively involved in the design of this initiative and was able to have OFSP prominently included among the six food groups in the Malawian diet<sup>1</sup>.

**Table 1 Project contributions to Malawi's ASWAp Strategic Objectives**

Project Objectives	Corresponding ASWAp Strategic Objectives	Project Achievement (1 October 2009–31 October 2012)
1. To improve vitamin A intake for rural vulnerable groups in central and southern Malawi through effective establishment of DVMS and a media-based demand creation campaign.	<p><b>1.2.1.c:</b> Increase productivity of cassava, sweetpotato, yellow-fleshed sweetpotato, and Irish potato in relevant areas</p> <p><b>1.2.2.a:</b> Promote dietary adequacy</p> <p><b>1.2.2.b:</b> Improve quality of diets for the most vulnerable groups</p>	<p><b>1.2.1.c:</b> Number of farmers cultivating improved OFSP from clean vines totals 62,425 farmers in Dedza, Zomba, Phalombe, Mulanje, and Chikhwawa districts by 2011/2012 planting season. In 2012/2013 rainy season, 35,053 HHs have been registered in the core districts of Dedza, Zomba, Phalombe, Mulanje and Chikhwawa. Further expansion beyond project target numbers expected through project activities in Year 3 and Year 4 and through linked activities by FAO, FUM and local farmer clubs. Productivity of <i>Zonderi</i> sweetpotato variety reaches 18 mt/ha during the 2010/2011 rainy season and 16 mt/ha during the 2011/2012 rainy season under farm conditions with clean vines, tripling the national sweetpotato average of 6 mt/ha (1995), 8.7 mt/ha (1996) and 14.2 (2010) (FAO/FEWS 1995-2007 in Chipungu <i>et al.</i>, 2011).</p> <p><b>1.2.2.a:</b> Awareness campaigns in October 2010 and in Year 2 covering over 22 villages in five districts. Radio programs, field days and agriculture shows Current weekly radio broadcasts (Saturdays) organized by FUM and Zodiac Radio Broadcasting of Malawi, previously by NASFAM, have reached wide audiences throughout Malawi. Focus on nutrition value of OFSP, sourcing of vines, and</p>

<sup>1</sup> As an example, see the SUN counseling cards:

([http://xa.yimg.com/kq/groups/8890406/1989591493/name/Full%20Set%20of%20CC\\_24.7.2012\\_final.pdf](http://xa.yimg.com/kq/groups/8890406/1989591493/name/Full%20Set%20of%20CC_24.7.2012_final.pdf)).

Project Objectives	Corresponding ASWAp Strategic Objectives	Project Achievement (1 October 2009–31 October 2012)
	<p><b>1.2.2.c:</b> Intensify nutrition education</p>	<p>good agronomic practice. Demand for quality vines has strongly increased and several vine multipliers are generating significant income from OFSP vine sales.</p> <p><b>1.2.2.b and 1.2.2.c:</b> Nutrition awareness through sensitization, training, and field days on the utilization and storage of roots and leaves is taking place at the district and extension planning area (EPA) levels. Three newly prepared modules for TOTs on utilization have been successfully tested in Mzimba, Kasungu, Dowa, Lilongwe, Dedza, and Salima districts from mid-February up to end of June 2012.</p>
<p><b>2.</b> Increase effective demand by changing the perception of sweetpotato and develop fresh root marketing chains for OFSP in the Blantyre market and reduce fluctuations in overall sweetpotato supply to the fresh market.</p>	<p><b>Key support service 2.a:</b> Conducting results and market-oriented research on priority technology needs and provision of technical and regulatory services</p> <p><b>Focus area 2.3.a:</b> Improve PPP for broader growth of the agriculture sector</p>	<p>Additional research expertise in marketing and M&amp;E has been recruited into the project on a cost-sharing basis with the Potato Program and will further support DARS programs in these technical areas.</p> <p>Universal Industries, a private food processing company, has committed investments in the OFSP value chain, testing different varieties provided by DARS for production of OFSP crisps and biscuits. Procurement of commercial equipment has been delayed due to macroeconomic situation in Malawi but is expected to proceed shortly.</p>
<p><b>3.</b> Increase the productivity and quality of sweetpotato in intensifying farming systems to ensure surplus production for sale and decrease the length of the hunger season.</p> <p><b>4.</b> Increase the capacity of DARS to produce clean, TC sweetpotato plantlets, maintain primary multiplication sites, and design and conduct seed systems and ICM research.</p>	<p><b>1.2.1.c:</b> Increase productivity of cassava, sweetpotato, and yellow-fleshed/OFSP, and Irish potato in relevant areas</p> <p><b>Key support service 1.a:</b> Institutional strengthening and development</p> <p><b>Key support service 1.b:</b> Capacity building</p> <p><b>Focus area 2.3.a:</b> Improve the PPP for broader growth of the agriculture sector</p> <p><b>Focus area 3.1:</b> Sustainable agricultural land management</p>	<p>Improved agronomic practices such as intercropping of sweetpotato with maize and soybeans, and improved 1-2-3 Sweetpotato Seed System are at various stages of research and dissemination and all have scope to contribute significantly to improved land management, generate surplus production and bridge hunger season at national scale.</p> <p>The Project is strengthening institutional capacity for research-for-development at Bvumbwe Agricultural Research Station (DARS) through infrastructure investments, training and collaborative research programs involving national and international scientists. This includes support to the tissue culture laboratory and establishment of a screen house and maintenance of 6.5 ha of land for primary multiplication of Zondeni OFSP variety and five other recently released OFSP varieties. These facilities are managed by DARS with backstopping by CIP. The Project supports secondary and tertiary multiplication by farmers under the supervision of NGO and government extension staff.</p> <p>The Project further provides partial support for the PhD research work of Ms. Pilirani Pankomera, a DARS scientist working on postharvest handling and storage of sweetpotato.</p>

The project is also closely linked with the SUN implementation process through several of our partners, including Concern Universal and the Farmers Union of Malawi, whose capacity for OFSP dissemination we have built and will continue to strengthen. Secondly, working from our four core



districts, the Project has established links with SUN activities in the neighboring districts of Mzimba, Kasungu (under FAO), Dowa, Lilongwe (under FUM) and Salima (under Kachele Club). The direct aim of this collaboration is to assure that farmers involved in SUN activities can access improved OFSP planting material from the DVMs in neighboring districts. These are neighboring districts where the project has trained government extension (DAES), Non-Governmental Organization (NGO) extension staff and lead farmers in OFSP multiplication, integrated OFSP production, pests and diseases management, post harvest handling and OFSP processing, utilization and value chains (CIP, 2012).

The Rooting out Hunger in Malawi project has completed its third year of a 4.5-year program. In the Year 3 midterm report that was submitted to Irish Aid in July 2012, project has reviewed all the project activities from 1<sup>st</sup> October 2009 up to 30<sup>th</sup> June 2012. This report is a supplementary report of the midterm report, including activities that could not be captured in July 2012. Specifically, these were:

- (1) the numbers of people reached through the voucher scheme under the Year 3 budget, including the numbers of registered beneficiaries in the 2012/2013 rainy season;
- (2) the final results of sweetpotato and maize intercropping trials;
- (3) findings from monitoring and evaluation, production surveys and marketing assessments; and
- (4) reports from the core Implementing Partners (Concern Universal, MVP and CADECOM) and joint program partners (FUM, FAO and Kachele Club).

## **2. OVERALL GOAL AND OBJECTIVES**

The overall objective of this 4.5-year project is to improve vitamin A and energy intake for at least 70,000 rural HH with women and young children using OFSP-based approaches and to ensure that at least 20% of the HH growing OFSP earn at least \$100/year from OFSP sales and increase their average sweetpotato yields by 50%.

## **3. TARGET GROUPS**

The principal target groups are poor, rural women, and their young children (6 months to 5 years of age) in sweetpotato-producing areas. Each NGO partner is applying additional specific criteria such as income, health status, and access to water. Although children and their women caregivers are a primary target group of the project, men likewise participate in nutrition education and dissemination activities. This ensures that they understand the importance of investing in nutritionally rich foods and good care-giving practices as they influence what decisions are made and how well decisions are implemented at the HH level.

A secondary target group is urban consumers, many of whom rely on purchased foods. Slums in major Malawian cities and their associated peri-urban areas are expanding, and poor urban women and children would particularly benefit from a nutrient-rich root. Understanding the breadth of preferences among high- and low-income consumers concerning fresh roots will eventually enable farmers to better target their variety selection and marketing strategies to specific areas and target groups, and by doing so obtain more revenue from sweetpotato sales.

#### 4. PROGRESS TOWARDS MEETING TARGET NUMBER OF HOUSEHOLDS

During the Reporting Period, the project has made further strong progress in reaching the target numbers. Table 2 summarizes the numbers of beneficiaries reached, acreage planted and yields achieved in project sites. In the rainy season of 2011/2012, 23,935 beneficiaries grew OFSP on a total area of 161.6 ha, more than doubling the figures from the previous year (10,968 beneficiaries on 73.4 ha). Preparations for the coming 2012/2013 rainy season indicate that over 27,000 HHs have already been registered to receive subsidized vine vouchers, while more beneficiaries will be reached through local vine marketing and additional development programs that have started to procure quality OFSP vines from project partners and to distribute these in a larger number of districts. This expansion of OFSP production beyond the initial voucher scheme and target districts will continue a trend already observed during the past year, and the project will closely assess and document this positive development.

**Table 2 Numbers of Beneficiaries Receiving OFSP Planting Materials through Subsidized Vouchers during the 2010/2011 and 2011/2012 Rainy Seasons and Registered for Year3 and Projected for Year4 through the three core Implementing partners**

Partner	District	2010/11 rainy season (Y1)			2011/12 rainy season (Y2)			2012/13 rainy season (Y3) (projected)		2013/14 rainy season (Y4) (projected)
		No. of hh	Area (ha)	Yield (mt/ha)	No. of hh	Area (ha)	Yield (mt/ha)	No. of hh projected	No. of hh registered	No. of hh
Concern Universal	Dedza	4,733	32.0	16	3,000	20.3	15	3,000	3,500	1,800
Concern Universal	Phalombe	859	5.8	20	3,235	21.8	18	3,000	7,053	1,800
Concern Universal	Mulanje	NA	NA	NA	3,492	23.6	18	3,000		1,800
Concern Universal	Balaka	NA	NA	NA	80	9.3	12	NA	1,000**	NA
Millennium Village	Zomba	3,250	21.9	18	8,000	54	18	3,000	8,000***	1,800
CADECOM	Chikhwawa	2,126	13.7	18	6,208	41.9	13	3,000	7,500	1,800
<b>Total</b>	<b>5 districts</b>	<b>10,968*</b>	<b>73.4</b>	<b>18</b>	<b>24,015<sup>†</sup></b>	<b>170.9</b>	<b>16</b>	<b>15,000</b>	<b>27,053***</b>	<b>9,000</b>

\*5,562 females (51%) and 5,406 males (49%); <sup>†</sup>15,209 females (63%) and 8,806 (37%) males. \*\*Balaka District under Concern Universal has requested to include 1,000 household who have been affected by prolonged drought this year. \*\*\*This figure refers to the Millennium Village project areas. An additional 9,000 HHs registered outside the border these areas are not included in the Table.

#### 5. RESEARCH STREAM 1: INTERCROPPING SWEETPOTATO AND MAIZE

##### Background

Maize is a staple food for Malawians. Smith (2012) noted that maize shortages, in part due to increasingly common dry spells, affect 1.6 million people (more than 10% of the population) every

year, and an estimated 47% of children have stunted growth because of under-nutrition, making them more vulnerable to illness and learning difficulties. In response to these challenges, the Government of Malawi has placed crop diversification at the core of its agriculture policy, and emphasizes the links with nutrition and health. In this context, sweetpotato has emerged as a crop that can contribute significantly to the country's food basket, especially in the months where maize is scarce and prices are high.

In the densely populated and intensively farmed districts of Malawi, soil fertility is declining and pests and diseases are expanding, resulting in poor yields and low quality of crops. Some types of intercropping have been shown elsewhere to tackle both of these constraints by improving soil quality and reducing the spread of pests and diseases. The objective of this on-station research was to determine the potential for intercropping sweetpotato and maize in Malawi and to assess the performance of different intercropping options for productivity gains and disease control.

### **Methodology**

Trials were conducted at Bvumbwe Research Station in two planting seasons, i.e. the 2010/2011 and 2011/2012 rainy seasons. The two seasons proved to be different in rainfall distribution and temperature, and different fields (with different soils and land use) were planted during these two seasons.

Four types of strip intercropping were practiced, these were (1) 2 ridges OFSP and 1 ridge maize as Treatment 1; (2) 1 ridge OFSP and 1 ridge maize as Treatment-2; (3) 1 ridge OFSP and 2 ridges maize as Treatment-3; (4) planted in the same ridge/row (intra-cropping) - 1 maize plant and 3 OFSP plants as Treatment-4. In the 2011/2012 rainy season, an additional OFSP monoculture and maize monoculture was also included. These were measured as Treatment-5 and Treatment-6. The data collected from Treatment 5 and 6 were for calculating the land equivalent ratio (LER). The OFSP Zondenii was harvested at 5, 6 and 7 months after planting (MAP) while Maize cv Mkango (SC627) was harvested once, at 4 MAP. Both seasons' assessments were conducted on-station at Bvumbwe Research Station in Blantyre. Lead farmers and agriculturists (government extension services and field managers of implementing partners) from various districts engaged in the OFSP program were invited to the Station during the field days. The views of the participants were collected to supplement the final results of the assessment.

### **Results**

#### **(i) General observation of the trial**

No serious damage by pests and diseases was observed for both crops maize or for OFSP during the two trial seasons. However, losses caused by theft and predation (birds) required some gap filling which we did in the second season's assessment. To redress these problems, the project hired three guards during both seasons.

In the second season, maize did not perform well ( $p < 0.01$ ) (Table 3). This might be due to erratic rains that affected poor germination and deprived soil fertility resulting in stunted maize plants; although, inorganic fertilizers were applied. The sweetpotato harvest after 5 months showed low storage roots yields and poor root quality (Table 4) probably due to poor soil conditions. Number of roots per plant was low and the size of roots small. *Alternaria* disease slightly infected sweetpotato stems at Replication 1 and 2. This disease incidence did not influence the storage root production. Damage by nematodes in the same replications was also found (data not shown). The rough skin

due to the damage by nematode might significantly influence the acceptance of sweetpotato roots in markets. On the other hand, absence of secondary infection of the damaged roots meant that these roots could still be accepted in local markets. Soil pests, not uncommon in Malawi, caused poor quality of sweetpotato planting material and storage roots.

**Table 3 Maize data, harvested 4 MAP across the two planting seasons (2010/2011 and 2011/2012)**

	Wt shelled after drying (mt/ha)
<b>Treatment</b>	
T1: 2 rows sp vs 1 row maize	3.30
T2: 1 row sp vs 1 row maize	3.56
T3: 1 row sp vs 2 rows maize	3.22
T4: Intra 3 sp plants and 1 maize plant	2.71
<i>P-value</i>	(*)
<i>LSD</i>	(0.529)
<b>Block</b>	
B1: field with sp harvested at 5 MAP	3.09
B2: field with sp harvested at 6 MAP	3.30
<i>P-value</i>	ns
<i>LSD</i>	-
<b>Season</b>	
2010/2011 rainy season	4.76
2011/2012 rainy season	1.63
<i>P-value</i>	**
<i>LSD</i>	0.456
<b>Grand mean</b>	3.20
<b>cv (%)</b>	24

Notes: \*\*: highly significant at p-value<0.01 with LSD 5%; in the brackets: p-value<0.1 with LSD 10%; and ns = non-significant.

**Table 4 OFSP Zondeni data harvested at 5, 6 and 7 MAP, intercropping with maize in four cropping models across two seasons of 2010/2011 and 2011/2012.**

	Number of marketable roots per plot	Wt marketable roots (mt/ha)	Total Yield storage roots (mt/ha)
<b>Treatment</b>			
T1: 2 rows sp vs 1 row maize	359	19.9	23.1
T2: 1 row sp vs 1 row maize	345	16.7	19.2
T3: 1 row sp vs 2 rows maize	278	18.0	20.4
T4: Intra 3 sp plants and 1 maize plant	387	19.3	21.5
<i>P-value</i>	**	ns	ns
<i>LSD</i>	59.6	-	-
<b>Environment (Harvest)</b>			
H1: 5 MAP	304	10.6	12.3
H2: 6 MAP	399	14.5	16.7
H3: 7 MAP	323	30.3	34.1
<i>P-value</i>	(*)	**	**
<i>LSD</i>	73.6	7.16	7.88
<b>Season</b>			
2010/2011 rainy season	323	24.0	27.3
2011/2012 rainy season	361	13.0	14.7
<i>P-value</i>	Ns	**	**
<i>LSD</i>	-	2.52	5.56

<b>Grand mean</b>	342	18.5	21.0
<b>cv (%)</b>	41.4	42.1	42.2

Notes: \*\*: highly significant at p-value<0.01 with LSD 5%; \*: significant at p-value<0.05 with LSD 5%; in the brackets: p-value<0.1 with LSD 10%; and ns = non-significant.

### (ii) Farmer Preferences

General perceptions and views based on aboveground observation were collected from farmers during each round of intercropping trials. Both maize and sweetpotato plants were still in the field. In the second season's assessment, our challenge was that only 36 (out of 75) participants filled in the questionnaire form, probably because some female farmers were illiterate and did not fill in the questionnaire for this reason. Farmers ranked each treatment according to their preferences (Ref: Annex 11 – Annual Technical Project Report submitted in October 2011 (CIP, 2011). Treatments that intercropped ridges of sweetpotato with ridges of maize were ranked highest during both rounds of trials (Table 5).

**Table 5 Opinions of Respondents Collected during the Two Open Days Conducted in 2010/2011 and 2011/2012 Rain Season.**

Treatment	First Season		Second Season	
	No. of Respondents	Rank	No. of Respondents	Rank
<b>T1: 2 ridges Zondeni and 1 ridge maize</b>	13	2	19	1
<b>T2: 1 ridge Zondeni and 1 ridge maize</b>	12	3	6	2
<b>T3: 1 ridge Zondeni and 2 ridges maize</b>	24	1	4	4
<b>T4: Planting in the same ridge 1 maize plant and 3 Zondeni plants</b>	3	4	0	6
<b>T5: Sole cropping of sweetpotato</b>	-	-	5	3
<b>T6: Sole cropping of maize</b>	-	-	2	5
<b>Total</b>	<b>52</b>		<b>36</b>	

### (iii) Maize yield versus OFSP yield

Table 3 shows the statistical analysis of maize yields across the two planting seasons. Yields were lower in the 2011/2012 rainy season compared to the 2010/2011 planting season (p<0.01). Across the two seasons, Treatment 1 (2 rows sweetpotato and 1 row maize) and Treatment 2 (1 row sweetpotato and 1 row maize) produced the highest yields (p<0.1). The area chosen was intensively used by the neighborhood community of Bvumbwe Research Station and was located in the densely populated part of the research station. The situation is therefore similar to the general conditions in the low-input agricultural systems outside the station.

Table 4 shows detailed information on the number of marketable OFSP Zondeni roots per plot, weight of storage roots in metric tons per hectare and the total yield of Zondeni in metric tons per hectare. Treatment 1 (2 rows sweetpotato and 1 row maize) produced the highest weight of marketable roots and the highest storage weight, while Treatment 4 produced the highest numbers of marketable roots. The interaction between treatments and harvest period across the two rainy seasons was significant with respect to the weight of marketable roots and total yield (p<0.05; data not shown). At 5 and 6 MAP, the difference for weight of marketable roots and total yield was not significant. However, it became significant at 7 MAP (p<0.01). The number of roots was increasing at 6 MAP (p<0.1), probably because maize had been harvested two months earlier and no longer competed with sweetpotato. The storage roots grew bigger and the marketable weight and total

yield increased accordingly at 7 MAP, while the number of marketable roots per plot at 7 MAP decreased, compared to the number at 6 MAP (Table 4). A significant correlation between weight of marketable roots and total yield ( $R > 0.25$ ) indicates that the total yield was determined primarily by the size of roots and not by the number of roots.

#### (iv) Impact on sweetpotato weevil incidence

Additionally, the roots and vines (stems) at 7 MAP were noticeably clean; the sweetpotato weevil incidence scored 5. In that period, the weevil population was maturing and sweetpotato fields not intercropped with maize were attacked by weevils. This is an indication that the low weevil incidence may be a result of the intercropping with maize. These initial observations from the two trial rounds would be consistent with the findings by Nampeera, *et al.* (2011) in Uganda. This study suggested that planting maize and/or onion as border crops for sweetpotato plants could prevent the sweetpotato weevils damaging the vines and storage roots while in the field. These improved agronomic practices warrant further adaptive research, complementing the longer-term breeding-for-weevil-resistance research work carried out by DARS and CIP. If successful, intercropping in combination with careful vine multiplication and distribution could be a ‘frontline’ technology to reduce weevil infestation.

#### (iv) The Land Equivalent Ratio (LER) Calculation

The efficiency of the intercropping is described by the Land Equivalent Ratio (LER), a tool for determining the efficiency of intercropping compared to monoculture. Any intercropping treatment with a LER of greater than 1 is more efficient than a monoculture (Mead & Willey, 1980; Ofori & Stem, 1987). L-sweetpotato was 1.12 and L-maize 0.67, giving a total LER of 1.79. We can therefore conclude that the intercropping between maize and sweetpotato is efficient and should be further explored as an agronomic practice that can potentially increase productivity and profitability of smallholder farming in Malawi.

#### (v) Gross Margin Analysis

Table 6 gives detailed information about the gross margin analysis of intercropping maize with sweetpotato during the two planting seasons. Sweetpotato make the overall largest contribution to profits. The highest profits were generated from Treatment 1 (2 rows of sweetpotato and 1 row of maize) and Treatment 4 (intra-cropping where 3 sweetpotato plants and 1 maize plant were planted in the same row) in the first season and Treatment 3 (1 row of sweetpotato and 2 rows of maize) in the second season (Table 6).

**Table 6 Gross Margin Analysis for intercropping maize and OFSP Zondeni per ha (in USD) in 2010/2011 rainy season (first season’s assessment) and 2011/2012 rainy season (second season assessment)**

	First season’s assessment (2010/2011 rainy season)*				Second season’s assessment (2011/2012 rainy season)**			
	T-1	T-2	T-3	T-4	T-1	T-2	T-3	T-4
<b>A. Income</b>								
<b>Maize Yield (Shelled after drying) (t/ha)</b> ( $p < 0.01$ ; first season); ( $p < 0.05$ ; second season) <i>LSD 5% = 0.6 for both seasons</i>	5.1	5.3	4.6	4.1	1.5	1.7	1.8	1.2
<b>Zondeni marketable yield (t/ha)</b> ( $p < 0.05$ ; <i>LSD 5% = 6.6 (first season); 3.5 (second season)</i>	28.8	21.2	19.5	26.5	11.0	12.2	16.5	12.4

<b>Sale of Maize (Mk 35/kg in 2011; Mk 50/kg in 2012)**</b>	1,082	1,124	976	870	284	322	341	227
<b>Sale of OFSP (Mk 100/kg)**</b>	17,455	12,849	11,818	16,061	4,166	4,620	6,249	4,696
<b>Total Income</b>	<b>18,537</b>	<b>13,973</b>	<b>12,794</b>	<b>16,931</b>	<b>4,450</b>	<b>4,942</b>	<b>6,590</b>	<b>4,923</b>
<b>B. Expenditure</b>								
<b>Maize seed*</b>	109	109	109	109	152	152	152	152
<b>OFSP vine cuttings*</b>	116	116	116	116	116	116	116	116
<b>Labor (land preparation, planting, weeding, fertilizer application)</b>	1,964	1,964	1,964	1,964	1,965	1,965	1,965	1,965
<b>Fertilizer for maize only</b>	102	105	101	105	102	105	101	105
<b>Total Expenditure</b>	<b>2,291</b>	<b>2,294</b>	<b>2,290</b>	<b>2,294</b>	<b>2,335</b>	<b>2,338</b>	<b>2,334</b>	<b>2,338</b>
<b>Profit</b>	<b>16,246</b>	<b>11,679</b>	<b>10,504</b>	<b>14,637</b>	<b>2,115</b>	<b>2,604</b>	<b>4,256</b>	<b>2,585</b>

\*Exchange rate: 1 US\$ = Mk 164.9 (before April 2012); \*\*, Exchange Rate in June 2012 when selling the maize and sweetpotato: 1US\$ = Mk264.05

## 6. RESEARCH STREAM 2: COMPARISON OF ZONDENI OFSP MATERIAL FROM PQS NAIROBI AND FROM DARS POSITIVE SELECTION

The Project is promoting the production and distribution of clean, virus-free planting material as a main strategy for increasing productivity and production of sweetpotato in Malawi. According to Fuglie *et al.* (1999) a yield gain of 30–50% could be obtained through healthy planting material. In order to determine the most effective way of generating such material, the project has compared two principal sources: (i) positive selection of clean vines at Bvumbwe Research Station, which has so far served as the source of clean planting material disseminated through the voucher system, and (ii) cleaning-up Zondeni OFSP material at the Plant Quarantine Service in Nairobi and re-importing it into Malawi.

From the initial observation, a number of attributes were observed and the most important attributes, like weight of marketable roots and yield, were chosen. The data were transformed into metric ton per ha. The two districts were accounted as replications. The analysis of variance was computed by Genstat (Anon., 2005). Across the two districts as replicate, an insignificant difference between the OFSP planting material from the positive selection technique and from PQS of Nairobi, was found on the weight of marketable roots and total root yield. It is likely that the positive selection method has been done intensively and producing an equivalent result to the PQS work done in Nairobi. Since we have done this trial only in one season, we need to repeat this trial in this coming rainy season to confirm this result.

## 7. RESULTS FROM MONITORING, EVALUATION AND MARKETING WORK

The project entered its third year of implementation in 2012. As part of systematic monitoring of project impact, a beneficiary and market assessment was conducted in October 2012 in Dedza, Zomba, and Phalombe and Chikhwawa implementation areas by Ted Nyekanyeka (M&E CIP officer in Malawi) and Eliya Kapalasa (Marketing CIP officer in Malawi). The assessment involved qualitative data collection from a sample of 10 beneficiary farmer groups and key-informants.

During the project duration, OFSP and especially the Zondeni variety has been gaining popularity among rural communities in Malawi. Knowledge about the variety's nutritional benefits, ease of

access of vines through the subsidized vouchers and growing market demand for OFSP were the major factors that influenced adoption of the variety by beneficiary households. The voucher system played a key role in fast-tracking diffusion to vulnerable households. However, sustainability mechanisms of the voucher process need to be further analyzed. It was also observed that female beneficiaries had greater knowledge about OFSP than their male counterparts during Focal Group Discussions (FGDs).

Sweetpotato yields in target districts have significantly increased, in part due to the dissemination of clean planting material of the high-yielding Zondeni variety. Furthermore, increased land allocation to the crop among the beneficiaries especially DVMs expanded production. Subsequently, OFSP has improved household food availability through lunch meal substitution, which in turn allows households to have maize flour over a prolonged period, especially during the lean season when food may become scarce among poorer households. Enterprise opportunities in the OFSP value chain have developed for women in the target areas and women engaged in OFSP development feel more empowered in decision making at household level. Similarly, the project has improved social capital among rural women, as they are benefitting from information and experience sharing through their membership in OFSP clubs.

The emerging OFSP value chain in Malawi has great potential for upgrading and diversification as long as bigger quantities of clean planting materials become available to producers. If this is achieved, farmers will be able to respond to the strong and increasingly diversified demand for OFSP in rural and urban markets. The project has started to explore several 'higher-end' markets including Shoprite in Blantyre, Food Zones Supermarket in Lilongwe, Annie's Lodge in Zomba, Victoria Hotel in Blantyre, Mapiri Lodge in Dedza, Lilongwe Sunbird Hotel and CrossRoads Hotel in Lilongwe. One of the findings from this explorative work has been an indication of substantial margins between farm-gate prices of about MK45/kg (USD 0.16/kg) and supermarket retail prices of MK1000/kg (USD 3.57/kg) for red-skinned to MK300/kg (USD 1.1/kg) for white-skinned sweetpotato. Clearly, the project will gain a more detailed and comprehensive picture of prices through the value chain study that will be undertaken in Year 4.

A further strategy for increasing OFSP supplies during the lean months is to promote winter cultivation of Zondeni. The project's 1-2-3 sweetpotato seed system fits well with the sweetpotato growing calendar in Malawi (Figure 1) and can be complemented with the Triple S (Storage in Sand and Sprouting) technology developed by CIP and partners in East Africa. Triple S enables farmers to keep roots healthy and prevent them from sprouting for several months until the end of the dry season in time for planting. Farmers in several districts were trained in Triple S, as described in detail in the Mid-Year Report.





**Figure 1 Fit of the 1-2-3 seed system with the sweetpotato growing calendar in Malawi.**

## **8. PARTNERSHIP MODEL IN THE ROOTING OUT HUNGER PROJECT**

The project is using three categories of partnership with NGOs and private sector implementing partners:

- Model 1: Partnership with a contract agreement and receiving subgrants, i.e. CU (Dedza, Phalombe, and Mulanje projects) and CADECOM and MVP.
- Model 2: Partnership without a contract agreement and with no subgrants: WALA, FAO, FUM, and Kachele Club.
- Model 3: Private-sector partnership: Universal Industries Ltd (UIL) and individuals who are interested in a business.

In Model 1, the Implementing Partners are directly contracted by CIP and report to the project against agreed work plans. Technical and financial reports are submitted twice a year and are annexed to the Project Annual Reports. CADECOM, CU and MVP are Model 1 Implementing Partners whereas WALA who were initially considered in this category preferred a Model 2 partnership.

In Models 2 and 3, partners enter into joint programs on OFSP development. Table 7 provides an overview of Joint Program Partners and the number of DVMs and farmers reached through these partnerships. The project provides technical support, clean planting material, and training of extensionists and lead farmers. In some districts, Joint Program Partners also procured drip irrigation kits through the project.

Private sector partners (Model 3), like Universal Industries Ltd, have shown their interest in producing the vitamin A rich biscuit and crisps. Research has been done on this matter by this private sector in the last few years and it has been backstopped by CIP and DARS. However, they could not continue producing biscuit and crisps from OFSP due to economic problem in Malawi. They postponed on purchasing the machinery to make the biscuit and crisp products. Two private sector partners have joint in multiplication of the OFSP. One is based in Kasungu and another one in Blantyre.

**Table 7 DVMs and farmers reached through Joint Program Partners**

Joint program IPs	District	DVM	Farmers involved		Area (m <sup>2</sup> )
			Females	Males	
<b>FUM</b>	Dowa	9	69	169	600
	Dedza	26	474	253	600
	Lilongwe	6	54	70	600
<b>FAO</b>	Kasungu	2	5	12	930
<b>FAO</b>	Mzimba	2	13	11	75
<b>WALA-Project Concern International</b>	Balaka (plus part of Machinga)	1	To be confirmed	To be confirmed	200
<b>WALA-Emmanuel International</b>	Machinga (plus part of Zomba)	1	To be confirmed	To be confirmed	460
<b>WALA-Emmanuel International and Save the Children</b>	Zomba (part of Chiradzulu)	2	To be confirmed	To be confirmed	180
<b>WALA-Safe the Children</b>	Chiradzulu (part of Zomba)	1	To be confirmed	To be confirmed	200
<b>WALA-Africare</b>	Mulanje	1	To be confirmed	To be confirmed	200
<b>WALA-World Vision</b>	Thyolo	3	To be confirmed	To be confirmed	200

In addition to the partnerships described above, the project is working very closely with Government through DARS and DAES. DARS plays a pivotal role in agricultural research services and DAES in diffusion of technologies to farmers. Currently, DARS has developed primary multiplication sites in all regions in Malawi and the project is backstopping this effort to strengthen DARS's capacity for producing clean OFSP planting materials and together with DAES disseminating it widely in Malawi using a 1-2-3 seed system approach. Furthermore, the Department of Nutrition, HIV and AIDS and Bunda College of the University of Malawi are close collaborators for aligning project activities to the Scaling up Nutrition 1000 Special Days initiative in Malawi.

## 9. PARTICIPATION IN THE NATIONAL AND INTERNATIONAL FORA

In September and October 2012, the project participated in international and national fora including:

- (i) Horticultural in-House Meeting organized by DARS in Salima District in September 2012,
- (ii) Sweetpotato for Profit and Health Initiative (SPHI) Regional Meeting organized by CIP Regional Office in Nairobi in September 2012
- (iii) International Society for Tubers and Roots Conference (ISTRC) held in Abeokuta, Nigeria in October 2012 (paper provided in Annex 8) that also involved visits to school feeding programs and knowledge sharing from the project.

Participation in these fora increased the visibility of project achievements and strengthened knowledge exchange beyond the direct project partners.

In addition, we backstopped our partners (CU, DARS, MVP, FUM, CADECOM, Kachele Club) during field days, agriculture shows, National Trade Fairs and important visits by the Irish Aid team:

- A visit by the State Minister for Overseas Development and Trade from Ireland in Feb 2012
- A visit by three MPs from Ireland in Aug 2012
- A visit by Irish NGOs from Mozambique and Zambia in Sep 2012
- A visit by mid-term Review (MTR) team from Ireland and other countries in SSA for Irish Aid projects in Malawi
- A visit by Irish Aid Evaluation on Disaster and Climate Change

Five field days/Agricultural Show/National Trade Fairs were held in Blantyre, Salima, Phalombe, Zomba, Chikhwawa, and Bvumbwe. Ministers, i.e. Minister of Agriculture, Local Government and State Minister of Agriculture and Vice President, opened each field day. Awareness campaigns were organized by FUM in Dowa District on the 15<sup>th</sup> of November 2012 (Figure 3).

On each occasion, we displayed OFSP products and the OFSP multiplication field.



**Figure 2 A visit by the Midterm Review (MTR) team from Irish Aid to a DVM in Dedza on 30 October 2012**

The DVM also functions as a centre for knowledge transfer on secondary and tertiary multiplication techniques, drip irrigation and pit storage, Triple S and sand storage for fresh roots.



**Figure 3 Farmers Union of Malawi awareness campaign in Dowa District backstopped by the Project. OFSP products, like golden bread, mandaza, chips, juices from leaves and roots, and one-mix pot with 3 food groups were displayed.**

## **10. SUPPORT FROM CIP REGIONAL OFFICE IN NAIROBI AND HEADQUARTERS IN LIMA**

The Project received strong technical and financial management support from the CIP Regional Office in Nairobi and Headquarters in Lima. Also, the CIP communications officer based in Lima has supported public awareness creation, training programs and resource mobilization through flyers, ToT modules, reports, and project proposals.

## 11. RISK MATRIX

During the Project implementation period, several risk areas have been noted and mitigating actions have been designed. Table 8 summarizes these risks and actions.

**Table 8 Risk matrix**

Risks	Likelihood of Occurrence	Level of Risk	Mitigating Action	Responsibility
Fuel scarcity	High	Low	Communication using emails, telephones and YouTube. Better coordination of travel.	CIP and implementing partners
Erratic rains	High	High for households who want to keep planting material for the next season	Triple S (Storage root in Sand and Sprouting) technology disseminated	Households, NGOs and DAES
Frost in Dowa, Dedza and Mulanje	Low – not always happening	High – frost has destroyed the sweetpotato plants in the field	Introduce “Low Tunnel” (black plastic cover) technique	CIP and DARS
Sweetpotato soil pests – sweetpotato weevils, white grub, and nematodes	High in some districts	High where pest populations are high, resulting in significant yield losses.	Integrated Pest Management. Intercropping	CIP, DAES, DARS and NGOs
Sweetpotato Virus Diseases (SPVD)	Low	Low – except in areas of high virus pressure	Roughing diseased plants	Farmers and DAES
Underspend	Low	Low	Speed up expenditure	CIP and sub-grantees
Devaluation and inflation in Malawi	High	High due to Increase of Fuel and food prices and influence the quantity of the project activities	Set the priority	Relevant government agencies, CIP and implementing partners

## 12. CONCLUDING REMARKS

The project is ending its Y3 activities on the 31<sup>st</sup> October 2012. As reported in detail in the midterm report submitted in July 2012, the project has expanded its implementing areas through Joint Program Partners in the 22 EPAs of 15 districts in the three regions (southern, central, and northern). The dissemination of OFSP vine cuttings by the 2011/2012 rainy season reached 62,425 HH, or 89.2% of the target figure at Project end. The number of registered HH beneficiaries for Y3 project implementation is 27,053 HHs. Each household will receive 300 OFSP vine cuttings at the onset of the first rains of the 2012/2013 rainy season. The subsidized vouchers will be committed from the Year 3 budget. The project’s Implementing Partners (CU, MVP, and CADECOM) have registered and supported beneficiary households and DVMs in 15 districts. At the end of Year 3, we have recorded altogether 169 DVMs (28.04 ha). Project activities, however, will focus only on the core districts of Dedza (under CU), Zomba (MVP), Phalombe and Mulanje (CU), and Chikhwawa (CADECOM).

### 13. FINANCIAL REPORT

The detailed Financial Report has been submitted separately in November 2012.

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