CIP
INTERNATIONAL POTATO CENTER
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Root and Tuber Crops for Agricultural Transformation in Malawi (RTC-ACTION Malawi)

Year 2 Progress Report (April 2017 –March 2018) and a No-Cost Extension Period (April–June 2018)

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A Progress Report for Year 2 (April 2017–March 2018) and a No-Cost Extension Period (April–June 2018)

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Disclaimer

The authors' views expressed in this report do not necessarily reflect those of Irish Aid.

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ACRONYMS

AEDC	Agriculture extension development coordinator
AEDO	Agriculture extension development officer
AYTs	Advanced yield trials
CADECOM	Catholic Development Commission
CBSD	Cassava brown streak disease
CDA	Community development assistant
CMD	Cassava mosaic disease
CIP	International Potato Center
DADO	District Agricultural Development Office
DAES	Department of Agriculture Extension Services
DARS	Department of Agricultural Research Services
DLS	Diffused light store
DNCC	District nutrition coordinating committees
DNHA	Department of Nutrition, HIV and AIDS
DSM	Decentralised seed multipliers
DVM	Decentralised vine multiplier
EAs	Extension agents
EGS	Early generation seed
EPA	Extension planning area
FAO	Food and Agriculture Organisation od the United Nation
HH	Household(s)
IITA	International Institute of Tropical Agriculture
KEPHIS	Kenya Plant Health Inspection Service
MBS	Malawi Bureau of Standards
MPU–CoP	Marketing, Processing, and Utilisation Community of Practice
NGO	Non-governmental organisation
NCE	No-cost extension
OFSP	Orange-fleshed sweetpotato
OFTs	On-farm trials
PRA	Participatory rural appraisal

R&D	Research and development
RTC-ACTION	Root and Tuber Crops for Agricultural Transformation in Malawi project
RTCDT	Root and Tuber Crops Development Trust
RTCs	Root and tuber crops
SAH	Semi-autotrophic hydroponic
SASHA	Sweetpotato Action for Security and Health in Africa
SMEs	Small and medium-sized enterprises
SP	Sweetpotato
SSU	Seed Service Unit
TC	Tissue culture
ToT	Training of trainers
UIL	Universal Industries Ltd
UP	United Purpose
UYTs	Uniform yield trials
VC	Value chain
WFSP	White-fleshed sweetpotato
WHH	WeltHungerHilfe
YAED	Youth in Agriculture for Economic Development
ZECC	Zero-energy cool chamber

EXECUTIVE SUMMARY

The International Potato Center (CIP), with funding from Irish Aid, is leading the implementation of a 5-year project entitled "Root and Tuber Crops for Agricultural Transformation in Malawi" (RTC-ACTION Malawi). The project is designed as a national research and development (R&D) programme, with technical coordination by CIP and close ties to the Root and Tuber Crops Development Trust for stakeholder engagement. The goal of RTC-ACTION Malawi is to increase the contributions of root and tuber crops (RTCs) to food security, nutrition, and incomes in Malawi. The project will do this by harnessing advances in RTC R&D and scale them up through potato, sweetpotato (SP), and cassava value chains (VCs) to meet the demand of farmers, consumers, processors, and traders in Malawi. Over the course of this 5-year project, at least 160,000 farming households (HH) will adopt improved technologies and practices and at least 500,000 consumers will benefit from nutritious RTC foods. In particular, RTC-ACTION Malawi will result in significant increases in productivity and sales revenues among at least 30,000 RTC smallholder farmers, and in improved diet quality of over 80,000 women and 60,000 children under 5 years of age. This report is a technical narrative for year 2 (2017–2018) of the RTC-ACTION project.

In the year, the cassava crop component was brought on board for implementation along with orange-fleshed sweetpotato (OFSP) and potato. The report describes activities carried out from April 30th 2017 to June 30th 2018 for potato and SP crop components, and for cassava from August 2017 to 30th June 2018. A no-cost extension was approved for the period April–June 2018. During this reporting period, work plans were developed and, together with implementing partner organisations, farmers and other actors along the VCs were engaged in various meetings, trainings, demos, and seed dissemination activities to ensure that capacity is built across the project activities.

To achieve objective 1 of the project (i.e. increased productivity, climate resilience, and nutritional value of RTC production systems), activities on seed systems of potato and OFSP from tissue culture lab, screenhouses, and open-field multiplication were implemented to produce early generation planting material which was multiplied further by farmers. This work was implemented in close collaboration with the Department of Agricultural Research Services, Department of Agriculture Extension Services, non-governmental organisations, and farmers. Team members also conducted a scouting study of fields to identify improved varieties of high-quality cassava planting material for distribution to beneficiaries in Y1 of the cassava crop component.

The Y2 project target called for 36,500 HH beneficiaries receiving high-quality planting material of improved varieties of potato, SP, and cassava. Instead, 40,844 farming HH were reached, which represents an achievement of 112%. Of these, 21,626 were female beneficiaries, or 53% of total beneficiaries. Further, 9,345, 20,301, and 11,198 HH received improved varieties and high-quality seed materials of potato, OFSP, and cassava, respectively. These beneficiaries are located in 87 extension planning areas, 428 sections, and 3,632 villages of the project's 23 districts.

CIP and partners facilitated the production and dissemination of 94,490 bundles of OFSP by vine multipliers. The estimated area from this dissemination is 255.12 ha on OFSP improved varieties planted with high-quality seed material. A total of 40,023 bundles of improved cassava varieties were procured and disseminated to the beneficiaries in January–February 2018. The bundles were potentially enough for 615.73 ha of improved varieties and planted with high-quality seed material.

Through public–private partnerships, the project produced 99.2 metric tonnes (MT) of early generation improved seed potato against a target of 100 MT. This quantity of seed is equivalent to 1,830,000 seed tubers (with average seed tuber weight of 50 g), a volume of seed enough for planting of 34.5 ha. A total of 44 MT out of the 91.5 MT were assigned for further multiplication. Of this amount 17 MT were disseminated to 18 decentralised seed multipliers across project districts,

7 MT were planted at Mbawa Research Station in Mzimba district, and 20 MT were disseminated to 9,345 target beneficiaries who received start-up seed for further multiplication. Seed disseminated to 9,345 beneficiaries was enough to plant 7 ha.

Apart from beneficiaries of planting materials, direct interventions were also provided to vine and potato seed multipliers with early generation planting materials and technical backstopping.

Activities on objectives 2 and 3 included trainings and meetings for farmers and stakeholders in order to facilitate knowledge delivery to rural and urban communities on nutrition for better HH use of the three crops. Further, the project teams implemented activities that facilitated access to markets of seed, vines, RTCs, and products. Key actors such as service providers, implementing partners, farmers, and care-group volunteers were trained to ensure that capacity is provided for effective project implementation along the VC and across project objectives.

Overall, the project is currently on track: in the 2 years 26% of the 5-year beneficiary HH target (160,000) have been reached. This is taking into account that in Y1 the project focused only on potato and SP and the target was at 120,000 HH. As cassava was brought on board, the yearly targets have since been revised to account for this new component.

1. BACKGROUND

1.1 INTRODUCTION

In support of Malawi's commitment to diversify and transform the country's agriculture into a sustainable and economically viable sector, the International Potato Center (CIP) received funding from Irish Aid to implement the project "Root and Tuber Crops for Agricultural Transformation in Malawi" (RTC-ACTION Malawi for short). RTC-ACTION is designed as a national research and development (R&D) programme with technical coordination by CIP and close ties to the Root and Tuber Crops Development Trust (RTCDT) for stakeholder engagement. The goal of RTC-ACTION Malawi is to increase the contributions of root and tuber crops (RTCs) to food security, nutrition, and incomes of Malawians. The project will do this by harnessing advances in RTC R&D and scale them up through the potato, orange-fleshed sweetpotato (OFSP), and cassava value chains (VCs) to meet the demand by farmers, consumers, processors, and traders in Malawi. The project is also collecting and preserving minor RTCs which have some value in certain communities of Malawi.

1.2 PROJECT OBJECTIVES

The specific objectives and expected outcomes of the RTC-ACTION project are the following:

Objective 1: Increased productivity, climate resilience, and nutritional value of RTC production systems

- Productive, climate-resilient, and nutritious varieties available for distribution (at least 10 released varieties and 8 new varieties to be released)
- Effective seed systems improve access to quality seed by farmers (at least 160,000 farmers)
- Improved crop management practices applied by male and female farmers across Malawi's agro-ecologies (at least 30,000 farmers increase productivity)
- An assessment of the importance of minor RTCs in production communities

Objective 2: Increased revenues, consumer-orientation, and nutrition outcomes of RTC value chains

- Diversified and expanded utilisation of potato, sweetpotato, and cassava for food security and improved nutrition (at least 80,000 women and 60,000 aged under 5)
- Improved supply chains for commercial processing of RTC foods (at least 7,000 farmers selling profitably to commercial processors)
- Efficient markets linking potato, sweetpotato (SP), and cassava producers with consumers and processors (at least 20,000 farmers realise 15% increases in RTC sales revenues)
- Improved post-harvest handling, storage, and transport capacities and practices (at least 1,000 farmers and traders benefit)

Objective 3: Effective policies and strengthened capacities for continued development of RTCs

- RTCDT effectively coordinates stakeholders for stronger policy support and more effective development investments in RTCs (at least one significant policy change, one planning improvement, and one service delivery improvement implemented)
- Human and institutional capacity strengthened to support continued innovation and development of RTCs (at least eight Malawian RTC researchers receive advanced degrees, and RTC modules integrated into public sector extension training programmes)

1.3 PARTNERS AND DISTRICTS OF IMPLEMENTATION

RTC-ACTION project implementation is led by CIP in partnership with the Department of Agricultural Research Services (DARS), the Department of Agriculture Extension Services (DAES), the Lilongwe University of Agriculture and Natural Resources as main government partners; non-governmental organisations (NGOs)—namely United Purpose (UP) in Thyolo, Chiradzulu, and Balaka) and Catholic Development Commission (CADECOM)–Chikwawa; private partners such as Universal Industries Ltd (UIL), Jacaranda, Youth in Agriculture for Economic Development (YAED)–Chiradzulu), Concern World Wide (Concern–Nsanje), Peace Corps Volunteers (nutrition, Bvumbwe), WeltHungerHilfe (WHH) (Chikwawa), Red Cross (Mulanje), and other commercial partners; and farmers and community groups.

The project is being implemented in 11 districts (Dedza, Mchinji, Ntcheu, Ntchisi, Neno, Lilongwe East and West, Dowa, Mzimba South, Thyolo, and Kasungu) for potato; 10 districts (Phalombe, Mulanje, Thyolo, Chiradzulu, Mwanza, Neno, Zomba, Nsanje, Chikwawa, and Blantyre) for SP, and 7 districts (Lilongwe East and West, Kasungu, Nkhata-Bay, Mzimba North and South, and Mangochi) for cassava. Potato and SP activities started in April 2017 for Y2, and the cassava crop component began in Y2 of project implementation; activities effectively started in August 2017 (Table 1).

Table 1. Project implementation areas

	Y1	Y2
District	19	23*
Extension planning area	45	91
Section	102	433
Villages	701	3,920

Note: Lilongwe and Mzimba have been demarcated into two districts each: Lilongwe East and West and Mzimba North and South.

The rainfall season started on time in most parts of the country (November–December). However, a mid-season dry spell affected the dissemination of planting materials to beneficiaries and planting of demonstration and experimental plots. Work commenced and was finalised when the rainfall normalised, though slightly late for root crops. This may affect the yields at harvest in some areas.

The project also increased its scope of crops under implementation by including minor RTCs. Initially, germplasm was collected, followed by multiplication and characterisation. Further activities like improvement programmes of these crops will be initiated.

1.4 KEY PROJECT RESULTS

This report provides progress of project implementation (April 2017–March 2018) and for a no-cost extension (NCE) period from April to June 2018. Dissemination of planting materials to beneficiaries is the key project component. The project's 5-year target is 160,000 farming households (HH) reached with high-quality planting material and improved varieties of cassava, potato, and SP and associated production technologies in order to increase crop productivity for food, nutrition, and incomes through the sale of excess produce and value addition. Key project results for Y2 are provided in a matrix as Table 2.

The Y2 target was 36,500 farming HH reached. Instead, 40,844 HH were reached, representing an achievement of 112% (Table 2). Of these, 21,626 are female beneficiaries, or 53% of total beneficiaries. Further, 9,345, 20,301, and 11,198 received improved varieties and high-quality seed materials of potato, OFSP, and cassava respectively. These beneficiaries are located in 87 extension planning areas (EPAs), 428 sections, and 3,632 villages of the 27 districts (Table 1; Fig. 1; Appendices 1a and 1b). The process of dissemination of planting material involved awareness creation to district

agriculture and development committees through meetings which were stepped down to community awareness by front-line agricultural staff and partners. Communities helped to identify beneficiaries. CIP provided guidelines to prioritise farm families with pregnant and lactating mothers, children under 5, HIV and AIDS members, and disabled/other disadvantaged persons in the community to ensure food and nutrition security as the primary project goal. Further, since the project is also working to commercialise RTCs in Malawi across VCs, the project worked to organise capable individual and farmer groups who can produce high-quality seed of improved varieties for producers of RTCs for sale to raw markets and agro-processing industries. As such, the crop components implementation teams worked with farmers, seed multipliers, community leaders, lead farmers, parents, service providers, policymakers, and stakeholders of RTCs across the VC.

CIP and partners facilitated the production of 94,490 bundles of OFSP by vine multipliers. These are vines which were recorded by vine multipliers bought and disseminated in the year by CIP, NGOs, and fellow farmers/groups/multipliers. At the seed rate of 370.37 bundles/ha (i.e. 37,037 plants/ha), these bundles are enough for 255.12 ha on OFSP improved varieties and high-quality seed material. The expected potential yield from this total area is 5,102.4 metric tonnes (MT) of OFSP roots produced in Y2 (using the national average productivity rate of 20 MT/ha).

A total of 40,023 bundles improved cassava varieties were procured and disseminated to the beneficiaries between January and February 2018. At the seed rate of 65 bundles/ha, the amount of cassava cuttings disseminated in 2017–2018 are enough for 615.73 ha of cassava of improved varieties and planted with high-quality seed material. At an average root yield of 20 MT/ha (national productivity average), this area of cassava could potentially provide 12,314 MT of cassava roots in Y2.

Through public–private partnerships, the project produced 91.5 MT of early generation improved seed potato against a target of 100 MT. This quantity of seed is equivalent to 1,830,000 seed tubers (with average seed tuber weight of 50 g). This volume of seed was enough to plant 34.5 ha. A total of 44 MT out of the 91.5 MT were assigned for further multiplication. Of this amount 17 MT were disseminated to 18 decentralised seed multipliers (DSMs) across project districts, 7 MT were planted at Mbawa Research Station in Mzimba district, and 20 MT were disseminated to 9,345 target beneficiaries who received start-up seed for further multiplication. Seed disseminated to 9,345 beneficiaries was enough to plant 7 ha.

A total of 125 accessions of minor RTCs (yams and cocoyams) were collected from across the country and are under multiplication at Chitedze Research Station. Collection of remaining RTCs will start in June 2018. The work is being implemented together with the expertise of Malawi germplasm resource centre in DARS to ensure its sustainable conservation. This is explored further in a brief discussion paper in Annex A.

Table 2 presents progress of indicator achievements towards increased productivity of RTCs for food and nutrition and commercialisation across VCs. Of more importance, the crop teams realised that capacity building is key to achieving the set targets. Trainings of partners, collaborators, beneficiaries/farmers, service providers, and VC actors across were implemented. These are discussed in the report and summarised in Table 2. (An Excel matrix with Y1 results and a database are submitted with the report for further reference on beneficiaries as Appendices 1c and 1d.)

Table 2. RTC-ACTION Malawi Indicator Matrix

Goal: To increase the contributions of RTC to food security, nutrition, and Incomes in Malawi											
	Baseline	Year 2					Cumulative Year 1 and 2				Explanation for 10% variation
		5-Year Target	Achieved			Achieved	Achieved			Achieved	
			Target	Total	Female		Target	Total	Female		
# Smallholder famers benefitting from the project categorized by gender	254,999	160,000	36,500	40,844	21,626	112%	50,500	54,456	29,281	108%	Contribution by NCE winter OFSP production
Objective 1: To increase productivity, climate resilience, and nutritional quality of RTC production systems											
Outcome 1.1: Productive, climate-resilient, and nutritious varieties available for distribution (at least 10 released varieties and 8 new varieties to be released)											
Potato (# varieties maintained for dissemination)	7	7	7	7			7	7		100%	
OFSP (# varieties maintained for dissemination)	6	6	6	6			6	6		100%	
Cassava (# varieties maintained for dissemination)		4	4	4			4	4		100%	
Outcome 1.2: Effective seed systems improve access to quality seed by male and female farmers (at least 124,000 farmers)											
Potato (# of farmers receiving/benefiting from improved seed)	58,999	40,000	9,000	9,345	3,949	104%	13,000	13,514	5,840	104%	
OFSP (# of farmers receiving/benefiting improved seed)	196,000	80,000	17,500	20,301	13,513	116%	27,500	29,744	19,277	108%	Contribution by NCE winter OFSP production
Cassava (# of farmers receiving improved seed)		40,000	10,000	11,198	4,164	112%	10,000	11,198	4,164	112%	
Potato (area under farmers on improved varieties)			10	11.2		110%	20	13.8		69%	
OFSP (area under farmers on improved varieties)			100	255.12		255%	200	353.67		177%	Contribution by NCE winter OFSP production
Cassava (area under farmers on improved varieties)			500	517		103%	500	517		103%	
Potato (area under improved varieties for seed multiplication ha)	133	50	9	13.1		146%	19	32.6		172%	More interest and expansion
OFSP (area under improved varieties for seed multiplication ha)	661.5	15	9	10		111%	31.5	38.3		122%	More interest and expansion
Cassava (area under improved varieties for seed multiplication ha)		1,500	15	16.8		112%	15	16.8		112%	
Potato (# farmers cultivating improved varieties M, F)	58,999	40,000	9,000	9,345	3,949	104%	13,000	13,514	5,840	104%	
OFSP (# farmers cultivating improved varieties M, F)	196,000	80,000	17,500	20,301	13,513	116%	27,500	29,744	19,277	108%	
Cassava (# farmers cultivating improved varieties (M, F)		40,000	10,000	11,198	4,164	112%	50,000	11,198	4,164	22%	

# HH with children under 5 among these	25,000	25,000	5,000	25,560		511%	10,000	31,468		315%	Targeting HH with <5
# HH applying improved crop management (M, F)	254,999	160,000	36,500	40,844	21,626	112%	50,500	54,456	29,281	108%	
Outcome 1.3: Improved crop management practices applied by male and female farmers across Malawi's agro-ecologies (at least 25,000 farmers increase productivity)											
Potato (% productivity increase from combination of variety, seed quality, and crop management (M, F)		15%	15%	N/A							Assessment to be conducted in Y3
OFSP (% productivity increase from combination of variety, seed quality, and crop management (M, F)		20%	20%	N/A							Assessment to be conducted in Y4
Cassava (% productivity increase from combination of variety, seed quality, and crop management M, F)		20%	5%	N/A							Assessment to be conducted in Y5
No. of new technology types under development/dissemination											
Potato genotypes on research (on station)	10	50	50	97		194%	100	147	0	147%	For increased gene pool
# of potato technologies tested on farm	5	4	2	2		100%	4	4	0	100%	
Potato uptake/under dissemination	10	12	12	12		100%	22	24	0	109%	
OFSP genotypes on research (on station)	50	50	50	83		166%	100	110	0	110%	For increased gene pool
# OFSP technologies on research (on farm)	10	12	9	9		100%	18	18	0	100%	
OFSP uptake (under dissemination)	6	12	9	9		100%	15	18	0	120%	
Cassava genotypes on research (on station)	20	20	20	28		140%	20	28	0	140%	
# cassava technologies on research (on farm)	3	6	1	1		100%	1	1	0	100%	
Cassava uptake (under dissemination)	3	6	1	1		100%	1	1	0	100%	
Potato (# in-vitro plantlets)	10,000	50,000	10,000	23,990		240%	20,000	34,268	0	171%	Sandponic and aeroponics
Potato (# minitubers—both aeroponic & sandponics)	100,000	500,000	80,000	106,650		133%	180,000	157,614	0	88%	For sandponic & field multiplication
OFSP # in-vitro plantlets	3,000	150,000	3,000	2,959		99%	6,000	6,328	0	105%	
OFSP # screenhouse cuttings	10,000	150,000	30,000	47,600		159%	60,000	82,500	0	138%	Increased no. of screenhouses in response to demand
Cassava (# in vitro)		10,000	1,000			0%	1,000	0	0	0%	Propagation in progress in KEPHIS & Ibadan
Potato seed—quantity MT) field grown seed)	100 MT	100	20	77		385%	40	99	0	248%	Production area expanded from 2 to 3.6
OFSP bundles of cuttings (# field grown seed)	250,000		50,000	94,490		189%	100,000	130,990	0	131%	

Potato (# commercial multipliers established M, F)	7	35	7	18		257%	14	39	3	279%	
OFSP (# commercial multipliers established M, F)	4	20	4	4	1	100%	8	8	2	100%	
Cassava (# multipliers established M, F)		56	14	15	0	107%	14	15	0	107%	
Potato (# farmer multipliers established M, F)	248		10	18	7	180%	20	608	287	3040%	Increased interest
OFSP (# farmer multipliers established M, F)	171		12	26	3	217%	24	43	11	179%	Increased interest
Potato—quantity seed (MT) marketed from private multipliers (commercial, farmer, by variety, M, F)	110		100	99.2		99%	200	106.5	7	53%	
OFSP (# of bundles marketed from private multipliers (commercial, farmer, by variety, M, F)			50,000	94,490		189%	75,000	130,990	0	175%	
Cassava seed marketed by multipliers (bundles)		44,800	10,000	11,200		112%	10,000	11,200	0	112%	
Potato yield in MT/ha national level	16.73			18							
OFSP in MT/ha national level	17.47			19							
Cassava yield at national level in MT/ha	21.94			19							
Cassava average production (MT) in target areas				159,742							
Potato average production (MT) in target areas	627,616			133,333							
Potato yield/ha in target areas	16.5			16.2							
OFSP average production (MT) in target areas	651			379,700							SP in general
OFSP yield/ha in target areas	2541			17.9							SP in general
Potato (productivity increase demonstrated at pilot sites)	19%	9%	3%								Assessment in Y3
OFSP (productivity increase demonstrated at pilot sites)	15%	9%	15%								
No. research publications/working papers	10		1	1		100%					
Potato (# technologies available for extension)	10		12	12							
OFSP (# technologies available for extension)	13		9	9							
Cassava (# technologies available for extension)			8	8							
Objective 2: To increase profitability, consumer orientation, and nutrition outcomes of RTC value chains											
Outcome 2.1: Diversified and expanded utilisation of potato, sweetpotato, and cassava for food security and improved nutrition (at least 80,000 women and 60,000 under-5s)											
# HH with improved diet diversity, including biofortified crops recognised (M, F, <5)	19%	80,000	16,358	17,267		106%	16,358	17,267	0	106%	
Under 5 (# HH with improved diet diversity, including biofortified crops recognised (M, F, <5) potato		13,109	3,278	6,109		186%	6,556	6,109	0	93%	Targeting HH with >4
Under 5 (# HH with improved diet diversity, including biofortified crops recognised M, F, <5) OFSP	23%	26,218	6,555	17,058		260%	14,555	24,622	0	169%	Targeting HH with >5
Under 5 (# HH with improved diet diversity,		13,109	3,278	8,177		249%	6,565	8,177	0	125%	Targeting HH with

including biofortified crops recognised M, F, <5) cassava											>6
# HH with improved food security (food security index change)	25,000	25,000	16,358	20,301		124%	16,358	20,301	0	124%	
# HH with <5 receiving nutrition education and counselling (M, F)	25,000	25,000	5,000	3,094		62%	10,000	4,081	0	41%	
# Caregivers with improved nutritional knowledge & knowledge of improved child-feeding practices—OFSP	1,500	1,500	300	3,048		1016%	300	3,048	0	1,016%	
Outcome 2.2: Improved supply chains for commercial processing of RTC foods (at least 7,000 farmers selling profitably to commercial processors)											
Crop revenue by farmers (M, F) selling into improved market chains and for commercial processing—potato	67		500	56		11%					Markets being developed
Crop revenue by farmers (M, F) selling into improved market chains and for commercial processing—OFSP	43		500	25		5%					Markets being developed
Crop revenue by farmers (M, F) selling into improved market chains and for commercial processing—cassava			500								
Average crop revenue among these potato farmers											
Average crop revenue among these OFSP farmers											
Average crop revenue among these cassava farmers											
Outcome 2.3: Efficient markets linking potato, sweetpotato, and cassava producers with consumers and processors (at least 20,000 farmers realize 15% increases in RTC sales revenues)											
Potato # farmers (M, F) selling into organised market chains)	3,000		600	640		107%	1,200	820	0	68%	
OFSP (# farmers (M, F) selling into organised market chains)	2,000		400	107		27%	800	287	0	36%	Marketing strategies being developed
Cassava (# farmers (M, F) selling into organised market chains)			1,000				11,000	0	0	0%	
% increase in farm-level income for the targeted HH (M, F)—potato	456		2%								
% increase in farm-level income for the targeted HH (M, F)—OFSP	109										
% increase in farm-level income for the targeted HH (M, F)—cassava											
Gross margin for potato seed/ha	548,400		600,000	1,277,983		213%					Improved yield
Gross margin for OFSP/ha	455,500		500,000	689,755		138%					Improved yield

Gross margin for cassava/ha											Not collected for cassava
Potato—farmgate price (table potato)	195			250							
OFSP—farmgate price	160			100							
Cassava—farmgate price				90							
Market price				120							
Potato—market prices	285			335							
OFSP—market prices	215			137							
Outcome 2.4: Improved postharvest handling, storage, and transport capacities and practices (at least 1,000 farmers and traders benefit)											
# farmers (M, F) benefitting from potato technologies	1,000	600	150			0%	357	99		28%	
# farmers (M, F) benefitting from OFSP technologies		200	40			0%	40	0		0%	
# farmers (M, F) benefitting from cassava technologies		200	40			0%	40	0		0%	
# storage technology facilities established for potato	248	50	10	6		60%	21	6		29%	
# storage technology facilities established for OFSP		5	3	4			3	4		133%	
Objective 3: Effective policy and strengthened capacity for continued development of RTC value chains											
Outcome 3.1: RTCDT effectively coordinates stakeholders for stronger policy support and more effective development investments in root and tuber crops (at least 1 significant policy change, 1 planning improvement, and 1 service delivery improvement implemented)											
# policy changes in support of RTC	0	2	1	0							
# successful advocacy campaigns by RTCDT	5	20	4	1		25%	11	1		9%	
Outcome 3.2: Human and Institutional capacity strengthened to support continued innovation and development of RTC (at least eight Malawian RTC researchers receive advanced degrees, and RTC modules integrated into public sector extension training programmes)											
# PPPs formed under the project	4		4	3		75%	8	6		75%	Marketing strategies being developed
# Active RTCDT members (stakeholder categories)	147		147	43		29%	294	273		93%	Need to broaden sensitisation as it is a new organisation
# researchers trained at MSc and PhD level for potato	2	2	1	1		100%	2	2		100%	Undergoing registration
# researchers trained at MSc and PhD level for SP	2	2	1	1		100%	1	1		100%	Undergoing registration
# researchers trained at MSc and PhD level for cassava	2	2	2	2		100%	2	2		100%	2 students undergoing registration
# Inspectors technicians and other staff trained—potato, SP, and cassava	150	150	30	36		120%	60	68	13	113%	Training was done during NCE

# of smallholders trained by the project—potato	25,000	40,000	9,000	9,345	3,949	104%	23,000	22,957	11,604	100%	
# of smallholders trained by the project—OFSP	25,000	80,000	17,500	20,301	13,513	116%	31,500	33,913	21,168	108%	
# of smallholders trained by the project—cassava		40,000	10,000	11,198	4,164	112%	50,000	11,198	4,164	22%	

NOTE: KEPHIS = Kenya Plant Health Inspection Service.

Figure 1. Map of Malawi showing implementation districts.

2. ACTIVITIES IMPLEMENTED TO DATE UNDER EACH OBJECTIVE

2.1 OBJECTIVE 1: TO INCREASE PRODUCTIVITY, CLIMATE RESILIENCE, AND NUTRITIONAL QUALITY OF RTC PRODUCTION SYSTEMS

2.1.1 Outcome 1.1: Productive, climate-resilient, and nutritious varieties available for distribution

Output 1.1.1: Disease-free planting materials of all released cassava, SP, and potato varieties produced

With its poor seed systems, Malawi faces the challenge of maintaining the genetic material generated by breeding programmes for RTCs due to the vegetative nature of propagation. Most of the released varieties disappear from the seed system before they proliferate among farmers due to low adoption rates resulting from poor technology transfer programming. Consequently, improved varieties are gradually lost and the country's efforts to improve productivity at farm level stagnate and/or regress. Research stations play a pivotal role in the maintenance of local and improved varieties of vegetatively propagated crops by maintaining disease-free planting materials under tissue culture (TC) facilities. The RTC-ACTION project recognises the importance of this. So, in collaboration with DARS, cultures of popular varieties are under maintenance to adequately respond to demands for clean planting materials from seed multipliers. Project activities that provide disease-free planting material for increased RTC productivity are summarised in Table 3.

Table 3. Summary of activities on Output 1.1.1

Activity	Activity Indicator	Y2				Reasons for Deviations
		Milestones	Target	Actual	Achieved	
Regularly subculture material (3–6 months' variety dependent)	At least 50 plantlets of each released potato and SP varieties	Every 3–6 months records made on sub-culturing by variety for the duration of the project period	50	50	100%	100% for potato; 50% SP. OFSP varieties to be reintroduced from Nairobi.
	20 plantlets for cassava varieties always in culture	Every 3–6 months records made on sub-culturing by variety	20	0	0%	This will be done in Y3.
Respond to demands for seed foundation material for further seed production	40,000 TC plantlets produced for potato	8,000 TC plantlets produced annually for potato	8,000	16,200	200%	Some plantlets were for a new sandponic screenhouse provided by DARS.
	40,000 TC plantlets produced for potato	8,000 TC plantlets produced annually for potato	8,000	7,740	97%	NCE period
	4,000 TC plantlets produced for SP	1,000 TC in-vitro plantlets produced annually for SP	1,000	2,860	286%	3 varieties for Bvumbwe & Nankhwali screenhouses
	4,000 TC plantlets produced for SP	1,000 TC in-vitro plantlets produced annually for SP	1,000	109	10%	Introduced from Nairobi during the NCE.
	9,500 TC plantlets produced for cassava	500 for Y2 and 3,000 annually for consecutive years for cassava	500	0	0%	Will be done in Y3.

Activity	Activity Indicator	Y2				Reasons for Deviations
		Milestones	Target	Actual	Achieved	
	Establishing semi-autotrophic hydroponic (SAH) unit at Chitedze	SAH at Chitedze established by end of March 2018	1	1	100%	Ongoing
Conduct regular disease-indexing protocols to ensure quality of released RTC varieties	Indexed TC and screenhouse material of released varieties tested	1 disease indexing conducted annually for released potato, SP, and cassava varieties 125 cassava samples of released varieties to be screened against cassava mosaic (CMD) and brown streak (CBSD)	1	1	100%	1 disease testing was done in the screenhouse using setosa grafting; plants were disease free. Cassava plants certified free of diseases will be multiplied in tunnels.

Regularly subculture material (3–6 months' variety dependent). The objective of this activity is to ensure availability of TC nuclear stocks at all times under containment.

Potato. The most important challenge for potato seed production is soil-born diseases such as bacterial wilt. In response CIP and DARS are running a soilless technology of potato seed production to have clean seed available to beneficiaries. The activity starts from TC (Fig. 2), where a 23,940 plantlets were produced (Table 3) for two aeroponic structures, one at Bvumbwe and one at Njuli (private) in FY 2017–2018 (16,200) and NCE (7,740 plantlets). From the TC lab, the plantlets were planted in the aeroponic screenhouse, a system introduced into the country in 2012 for the soilless tuber production (Fig. 3) and ordinary screenhouse (Fig. 4). The unit structure is expected to produce seed for more than 1 ha. RTC-ACTION Malawi engages private partners to ensure sustainability of its interventions. In this regard the total plantlets produced during the NCE period—2,250 plantlets of 'Zikomo' (750), 'Rosita' (750), and 'Chuma' (750) varieties were transferred to Njuli Farm for minituber production.

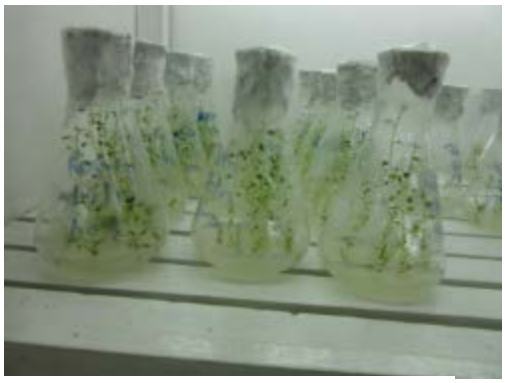

Figure 2. Potato plantlets in TC lab.

Figure 3. Minituber production in aeroponics.

Figure 4. Potato plantlets planted in pots with sand.

Response to demands from seed multipliers for foundation material for seed production

Sweetpotato. Under OFSP screenhouse production, the old stocks were removed and rehabilitated (Fig. 5) in preparation for planting new stocks from TC. A total of 84 (Fig. 6) plantlets were planted in the screenhouse at Bvumbwe; expansion continued within the screenhouse until filled to capacity. Currently, there are 3,162 pots planted (Fig. 7, left). CIP provides technical support to the screenhouse privately owned by Nankhwali farm (Fig. 7, right) that has increased the number of pre-basic SP planting materials.

Figure 5. Screenhouse emptied and rehabilitated.

Figure 6. TC plantlets, transplanted in the screenhouse.

*Figure 7. OFSP seed multiplication in the screenhouse at Bvumbwe Research Station (*left*) and screenhouse multiplication by Nankhwali farm in Mulanje district (*right*).*

Cassava. The International Institute of Tropical Agriculture (IITA) is establishing a semi-autotrophic hydroponic (SAH) unit for the rapid multiplication of cassava planting materials for feeding into the seed multiplication programme. During the reporting period, IITA commissioned and commenced work in the set-up of the unit at IITA Malawi offices. Construction work and procurement of laboratory equipment and supplies are currently at an advanced stage. Lab operations are expected to begin within Q1 of Y3.

In addition, from the 20th to the 30th of May 2018, IITA and DARS–Malawi each sent one staff for formal training in the management and day-to-day operation of the SAH unit at Ibadan, Nigeria, where IITA maintains a fully licensed and operational SAH facility. Once the unit is completed and operational in Malawi, we expect that the trained staff will be responsible for operating the unit and training of other members of staff.

Figure 8. RTC-ACTION staff from Malawi at the SAH laboratory training at IITA–HQ in Ibadan, Nigeria.

Five-hundred screenhouse plants in Y2 (of cassava component) and 3,500 in the final year's plants will be acclimatised annually. A total of 1,000 indexed cassava plants were produced in Y2 and 3,000 in each of the consecutive years.

Conduct regular disease indexing to ensure quality planting materials of released RTC varieties

Sweetpotato. As shown in Figure 7, disease-free SP planting materials have been produced in the screenhouses at Bvumbwe, using *Ipomoea setosa* as the indicator plant for virus detection. *Setosa* is a plant belonging to the SP family that shows virus signs when grafted with an infected SP plant. *Setosa* test through grafting on SP plants in screenhouse showed no infections (Table 3).

Cassava. A total of 210 visually non-symptomatic plant samples were collected from various research stations and farmer fields across the country during the NCE period. These samples were being screened against two major diseases—cassava mosaic disease (CMD) and cassava brown streak disease (CBSD). Of the 210 samples analysed, 6 tested positive for CMD, 11 for CBSD, and 1 had a co-infection (CMD and CBSD). Multiplication of those that were verified to be clean is under way in the tunnels at Chitedze (Fig. 9). Under multiplication are varieties 'Chamandanda', 'Chinangwa 1' and 'Chinangwa 2', 'Kalawe', 'Mbundumali', 'Mkondezi', 'Mpale', 'Mulola', 'Phoso', 'Sagonja', 'Sauti', and 'Yizaso'.

Figure 9. Indexed clones being multiplied in polythene tubes at Chitedze Research Station.

Output 1.1.2: New improved varieties released

Improvement of varietal adaptation to the climate and soil conditions remains the best-bet and most sustainable method for improving productivity in the smallholder-dominated cropping systems of Malawi. In line with the RTC-ACTION project's objective to make productive, climate-resilient, and nutritious varieties available for distribution, CIP and DARS work to strengthen the breeding programmes of RTCs and contribute to the release of varieties. Extensive on-farm evaluation of promising genotypes is also done with feedback from farmers to guide selections

and recommendations for release. Owing to the long-term nature of breeding work, the institutions are building on prior breeding efforts to conduct advanced genotype evaluations on research stations and on farmers' fields. Activities on the development of new varieties are listed in Table 4.

Table 4. Summary of activities on Output 1.1.2

Activities	Activity Indicator	Year 2				Reasons for Deviations
		Milestones	Target	Actual	Achieved	
Conduct RTC participatory rural appraisal (PRA) in target communities to gather cassava, potato, and SP variety characteristics preferred by farmers & end users	1 PRA study completed by end of Y2; at least 5 characteristics identified	PRA study for potato & OFSP	2	2	100%	Data collected and analysed; draft report done during the NCE.
		PRA study conducted for cassava	1	0		To start in September 2018
Source and identify appropriate potato, SP, cassava, yam, and cocoyam RTC germplasm with different required genetic traits	50 potato genotypes introduced and/ or collected locally	Introduce 25 potato genotypes by end of Y1 and an additional 25 by end of Y2.	25	97	388%	More genotypes with a wide range of attributes were sourced and introduced to widen the screening base.
	25 OFSP genotypes introduced and/or collected locally	Introduce 25 SP genotypes by end of Y2.	25	37	148%	More genotypes with a wide range of attributes were sourced and introduced to widen the screening base. Screenhouse multiplication of introduced germplasm at Bvumbwe during the NCE.
	100 cassava genotypes introduced and/or collected locally	Introduce 100 cassava genotypes by end of Y2	100	23	23%	104 plantlets of 23 yellow root cassava accessions from Nigeria. Additional clones from KEPHIS have been requested and are under production in TC
Conduct on-station and on-farm variety selection trials	16 on-station potato variety trials conducted on-farm	4 on-station potato trials conducted annually to Y4	4	2	50%	Seed material is being bulked for more on-farm sites. Harvesting done during the NCE.
	20 on-station SP variety trials conducted	5 on-station SP trials conducted annually for 3 years	5	10	200%	Many clones were available, therefore a wide gene pool for variety development. Harvesting of trials was done during the NCE
	36 SP on-farm trials (OFTs) conducted	12 OFSP OFTs conducted annually for 3 years	12	12	100%	Both winter and rain-fed OFTs were conducted for evaluation. Summer trials were harvested during the NCE.

Activities	Activity Indicator	Year 2				Reasons for Deviations
		Milestones	Target	Actual	Achieved	
	15 on-station cassava variety trials conducted following the breeding	5 on-station cassava trials established in Y2	5	10	200%	Availability of germplasm for testing enabled more trials to be done within the budget. Trial monitoring and data collection done during NCE.
	92 on-farm cassava on-farm variety trials conducted	20 cassava on-farm cassava variety trials established	20	20	100%	Mid-season dry spells made planting of OFTs challenging. Trial monitoring and data collection done during NCE.
		3 promising cassava clones identified for release	3	7	233%	Availability of enough clones from previous trials from both DARS and IITA.
Promotion and dissemination of new improved varieties among smallholder farmers	At least 10,000 famers have access to improved cassava varieties	10,000 famers receive and plant improved cassava varieties	10,000	11,198	112%	Dry spells made the exercise of sourcing and distributing seed a challenging.

Sweetpotato. Under SP PRA targeting, several activities across the VCs to gather variety characteristics preferred by farmers and end-users are in progress. The results will inform a quantitative base for SP breeding in Malawi.

As a process of variety development, the SP breeding team conducted a multilocation trial in 2016–17 and 2017–18 of 13 genotypes, which led to the release of three new varieties in March 2018. Evaluation was participatory with farmers for agronomic (Fig. 10) and taste (Fig. 11) traits and processors, mainly for crisping traits. These new varieties are BV11/150A, BV11/131, and BV11/172A (Fig. 12).

Figure 10. Participants sampling raw OFSP during the trial harvest at Bvumbwe.

Figure 11. Participants tasting boiled SP during the trial harvest at Bvumbwe.

Figure 12. Newly released SP varieties of Malawi.

Through initiatives by CIP to strengthen national breeding programmes, seeds were obtained in 2010 from Uganda, which is a main CIP platform for SP breeding in East Africa. The seed nursery was planted at Bvumbwe in 2011 (hence the coding BV11; BV for Bvumbwe in 2011) and the evaluation process followed in different agro-ecologies over seasons. RTC-ACTION contributed to the evaluation of the genotypes across sites in the 2016–17 summer and winter seasons (Table 4). BV11/131 has been named as 'Royal choice' due to its attractive purple-skin colour (purple being a royal colour). The other varieties are 'Msungabanja' (BV 11/150A) and 'Mthetsanjala' (BV11172A). The attributes for the new and old varieties are summarised in Table 5 and compared with old varieties (Table 6). In general, we have added three deep OFSP, high-yielding and widely adapted varieties that are available to farmers. Among the old varieties, the only deep OFSP that is high yielding and widely adapted is 'Kadyaubwerere'. Although a deep OFSP, 'Anaakwanire' has specific adaptation to high rainfall areas. Further, Malawians still prefer varieties with high dry matter content of at least >30%; the current ones are more than 30% (Table 5). In addition, they are early maturing varieties (4 months), closely competing with 'Kaphulira' (3.5 months). Most important, the international chain stores have been demanding purple-skinned varieties, which we did not have (ours were very light purple). On processing, the varieties can easily be made into puree and BV11/131 is very good for crisping. The new releases are being prepared for cleaning to be followed by TC preservation and propagation for screenhouse production.

Table 5. OFSP varieties released in 2018

Attribute	BV11/131	BV11/150A	BV11/172A
Family	NASPOT 1	New Kawogo	New Kawogo
Proposed name	Royal choice	Mthetsanjala	Msungabanja
Special traits	Big root size, widely adaptable, moderate to tolerant to sweet potato virus disease	Big root size, and widely adaptable	Big root size, and widely adaptable
Growth habit	Spreading	Semi-erect	Spreading
Dry matter (%)	31	31	32
Time of maturity	4	4	4
Potential yield (t/ha)	35	30	30
Root flesh colour	Deep orange	Deep orange	Deep orange
Root skin colour	Deep purple	Purple	Purple

Table 6. OFSP varieties released in 2011

Attribute	Genotype				
	LU06/0527	LU06/0146	LU06/0428	LU06/0252	LU06/0028
Family	SPN/O- Local crossing block	Mugamba- CIP variety, local crossing block	Mugamba- CIP variety, local crossing block	Mafutha seeds- RSA in local crossing block	Ejumula seeds- Uganda
Given name	Chipika	Mathuthu	Kaphulira	Kadyaubwerere	Anaakwanire
Growth habit	Spreading	Spreading	Spreading	Very spreading	Spreading
Primary vine colour	Green	Green	Green	Green with purple veins	Green
Shape of lobes	Round	Lobed	Hastate	Lobed	Lobed
Dry matter %	30	29	30	31	30
Time to maturity	5 months	5 months	3.5 months	5 months	6 months
Yield (MT/ha)	35	25	35	35	*25*
Tuber skin colour	Pale orange	Pale purple	Cream	Pale purple	white
Tuber flesh colour	Orange	Orange	Pale orange	Deep orange	Deep orange
Roots/ plant	3	4	3	4	6

Efforts to develop new varieties are designed to resolve new challenges in terms of pests and diseases, nutrition, and resilience, and to meet end-users' needs. We continue to develop new varieties, where on-station trials were implemented in 2016–17. A total of 83 promising genotypes within the series of the breeding scheme were selected for advanced evaluation and have been planted in 2017–18. The 10 trials planted under on-station and 12 OFTs as shown in Table 4 are:

- SP crossing block
- 2 white-fleshed sweetpotato (WFSP) clonal evaluation trials
- 2 OFSP clonal evaluation trials
- WFSP advanced yield trial (AYTs)
- OFSP AYTs
- 2 WFSP uniform yield trials (UYTs)
- OFSP UYTs (also referred to as multiplication trials)

Twelve evaluation OFTs were planted in Mulanje, Mwanza, Neno, Phalombe, Thyolo, and Zomba districts (Table 7) as implementation districts of RTC-ACTION. However, nationally, the trial has also been planted in other districts under the supervision of research and experimental stations. The trials have since been harvested during the NCE period. Data analysis is in progress for reporting.

Table 7. Host farmers for SP OFTs planted at farmers' fields

District	EPA	Section	Village	Host Farmer
Thyolo	Makwasa	Malamulo	Mkusa	Tenford Duli
Zomba	Dzaone	Mpulanya	Mphulunya	F. Wasi
Zomba	Thondwe	Thamanda	Malajira	Isaac Linje
Neno	Neno	Chikalema	Phewa	Lumbadzi Farmer Field Sc.
Neno	Neno	Kalion	Galeta 2	Tiyanjane Club
Zomba	Thondwe	Potani	T/A Mlumbe	Jonas Chilere
Thyolo	Thyolo Centre	Nkolokosa	Nkolokosa	Amadou Major
Mwanza	Thambani	Kalanga	Machilika	John Kaudani
Mwanza	Mwanza Centre	Kunenekude	Mpima	Mrs. Jesimani
Mulanje	Msikawanjala	Samera	Chimwala	Stella Mkwandala
Phalombe	Waluma	Nyambalo	Subili	Charles Malata a
Zomba	Chingale	Masala	Kapasa	Zobwe farmer group

Further, 25 varieties have been introduced from Mozambique for evaluation in Malawi. These will enter into preliminary evaluation in Y3 of the project. Currently, they are under multiplication in screenhouse and they will soon be multiplied under open-field conditions.

Potato. Significant achievements to ensure that new potato varieties meeting farmers needs as well as being resilient to climate change are released have been made. A total of 97 potato clones were introduced, 60 were from Scotland and 37 were from Kenya. Additionally, two on-station trials for the introduced clones have so far been done at Bembeke Research Station in Dedza and Tsangano in Ntcheu. Potato clones were also planted for multiplication at Bembeke Research Station for maintenance of germplasm for future trials as evaluation sites and seasons increase (Fig. 13).

Cassava. A contribution to the "Combating of vitamin A deficiency project" in Malawi, the project leveraged on IITA's long-term breeding work on beta-carotene–rich cassava germplasm at Ibadan, Nigeria, in order to source unique genetic material which can be evaluated in Malawi for yield and disease resistance towards release. As such, 104 plantlets of 23 yellow root beta-carotene cassava accessions (in TC) were received on January 28th 2018 from IITA–Ibadan. Of these, 94 plantlets were successfully planted in humidity chambers for post-flask management at IITA-Malawi, Lilongwe. These genetic materials are currently under multiplication in readiness for evaluation in the 2018–19 season (Fig. 14). There were also on-station and on-farm variety selection trials.

Figure 13. Harvesting of potato clones at Bembeke sub-Research Station.

Figure 14. Cassava genotypes introduced from Nigeria in 2018 maintained at IITA- Malawi.

In the 2016–17 season, seven on-station and 13 OFTs were established; all trials were harvested in December 2017. The clones that were high yielding and showed some level of tolerance to the major cassava pests and diseases were selected (Fig. 15) and advanced for further evaluation both on-station and on-farm.

*Figure 15. Harvesting, weighing (*left*), and checking for root CBSD in cassava trials (*right*) at Chitala Research Station.*

At Mkondezi Research Station, the site for the trial was water-logged, resulting in very low yields and stunted growth. Drawing lessons from this, plans are underway to construct waterways around the area where the 2017–18 trials have been planted. Tables 8–10 provide the list of cassava trials planted from December 2017.

Table 8. Name of trial and number of entries harvested by IITA in 2017

S No.	Stage	Entries Selected per Research Station		
		Chitala	Chitedze	Total
1	Seedling evaluation trial	268	12	280
2	Preliminary yield trial	13	0	13
3	AYTs	2	0	2
5	Local germplasm evaluation	0	11	11
	Total	**283**	**23**	**306**

Table 9. Number of harvested cassava on-station breeding trials by DARS

Trial Name	No. of Entries (2016–17)	No. of Selected Clones	Comments
Seedling nursery	3448	65	Selections advanced to clonal trial
Clonal evaluation trial	89	41	Selections advanced to preliminary yield trial
Preliminary yield trial	17	6	Materials to be multiplied
UYTs	14	6	Selections planted on-station and on-farm
Genotype by environment trials (regional introductions)	28	13	Selections planted on-farm

Table 10. 2017/18 Cassava research trials established and hosted by DARS and IITA

Trial	Location (lead institution)	Entries
AYT	Chitala (IITA)	17
Clonal evaluation trial	Chitala (DARS)	63
Clonal evaluation trial	Chitala (IITA)	282
Local germplasm evaluation trial	Chitedze (IITA)	13
Mapping sources of CBSD and CMD resistance in Malawian cassava genotypes and quantification of viral load	Chitala, Mkondezi (IITA)	12
Preliminary yield trial	Chitala (DARS)	40
Seedling evaluation trial	Chitala (IITA)	5266
Seedling evaluation trial	Chitedze (DARS)	868
UYT (CUYT A)	Chitala, Chitedze, Mkondezi, Bvumbwe, Makoka (DARS)	16
UYT (CUYT B)	Chitala, Chitedze, Mkondezi (DARS)	12

Ten on-station trials have been established, with IITA and DARS each hosting 5 trials (Table 11). In addition to these, 9 OFTs have been established for the genotypes L11/0231, L11/0075, and CZ10/021, with 'Mpale' and 'Mbundumali' served as checks. Data collection and monitoring were done in all trials. Furthermore, most of the trials show gaps because of poor sprouting due to dry spells that affected most districts in January. Routine disease assessment (Fig. 16) revealed some diseases at Chitala Research Station, whereas at all other research stations no major disease has been observed. Three months of data have been collected already in all trials. DARS, in collaboration with the DAES, established seven cassava OFTs in the 2017–18 season (Table 11).

Table 11. Farmers hosting 2017/2018 on-farm cassava trials for the RTC-ACTION project

District	EPA	Host Farmer	Gender	Clones	Date Planted (2018)
Kasungu	Kaluluma	Joseph Mwale	Male	3 clones, 2 checks	18/01
Kasungu	Kaluluma	Daniel Moyo	Male	3 clones, 2 checks	19/01
Kasungu	Kaluluma	Benford Phiri	Male	3 clones, 2 checks	19/01
Kasungu	Kaluluma	Annet Phiri	Female	3 clones, 3 checks	18/01
Nkhatabay	Tukombo	Mgodi Phiri	Male	4 clones, 2 checks	09/02
Nkhatabay	Mpamba	Tael Chiumia	Male	4 clones, 2 checks	09/02
Nkhatabay	Limphasa	Joseph Nyirongo	Male	4 clones, 2 checks	08/02

Figure 16. Highlights of trial performance (left– right): termite control trial, Clone UG 05 showing signs of CBSD on both leaves, and stems at Chitala Research Station.

Three promising cassava clones identified for release. Seven cassava clones have been identified to have distinct, uniform, and stable performance in key agronomic parameters to warrant inclusion in the national breeding programme's multilocational trials for eventual release as improved varieties. These clones (MM06/139, I020452, and MM06/0045) were submitted to DARS for further evaluation with four others identified by DARS: L11/0231, L11/0075, CZ10/0051, and CZ10/021 (Fig. 17).

Figure 17. IITA AYT performance at Chitala Research Station.

Five on-station cassava trials established. From June 25th to June 30th 2018, IITA collected data of all breeding and agronomy trials under the RTC-ACTION project at the "6 months after planting (6 MAP)" stage (Table 12).

Table 12. Progress of data collection in breeding trials

Trial	Sites	Location (Research Station)	Data Collected
AYT	1	Chitala (IITA)	Incidence and severity of CMD, CBSD, CGM, CM, & whitefly attack. Plant height and leaf retention.
Clonal evaluation trial	1	Chitala (DARS)	Incidence and severity of CMD, CBSD, CGM, & CM. Plant height and leaf retention.
Clonal evaluation trial	1	Chitala (IITA)	Incidence and severity of CMD, CBSD, CGM, CM, & whitefly attack. Plant height and leaf retention.
Local germplasm evaluation trial	1	Chitedze (IITA)	Incidence and severity of CMD, CBSD, CGM, CM, & whitefly attack. Plant height and leaf retention.
Mapping sources of CBSD and CMD resistance in Malawian cassava genotypes and quantification of viral load	2	Chitala, Mkondezi (IITA)	Incidence and severity of CMD, CBSD, CGM, CM, & whitefly attack. Plant height and leaf retention.
Preliminary yield trial	1	Chitala (DARS)	Incidence and severity of CMD, CBSD, CGM, & CM. Plant height and leaf retention.
Seedling evaluation trial	1	Chitala (IITA)	Incidence and severity of CMD, CBSD, CGM, & CM. Tagging of diseased plants.
Seedling evaluation trial	1	Chitedze (DARS)	Incidence and severity of CMD, CBSD, CGM, & CM. Tagging of diseased plants.
UYT (CUYT A)	5	Chitala, Chitedze, Mkondezi, Bvumbwe, Makoka	Incidence and severity of CMD, CBSD, CGM, & CM. Plant height and leaf retention.
UYT (CUYT B)	3	Chitala, Chitedze, Mkondezi (DARS)	Incidence and severity of CMD, CBSD, CGM, CM, & whitefly attack. Plant height and leaf retention.

Additionally, maintenance work (weeding and employment of security guards) was conducted in all the seven trial sites and crossing blocks. To improve project visibility and awareness, IITA designed and mounted signposts at all trial sites.

The outlook of the trials is positive (Fig. 18); however, there is a waterlogging challenge at Mkondezi which required a drainage facility to be dug around the trial. There is also a heavy infestation of termites at Chitala and Makoka, highlighting the importance of the termite trial being conducted by the project.

Figure 18. One of the promising lines showing tolerance to CBSD on roots and leaves in Salima.

Under this activity, agronomic data collection and disease scoring were conducted during the NCE period. Scoring was done for common cassava pests and diseases (e.g. CBSD, CMD, CM, and plant height). A general observation at 6 MAP shows that out of the three clones being tested on-farm, only clone L11/0075 is withstanding both CMD and CBSD disease pressure in all the replicates and across the farmers' fields. The other two clones are succumbing to CMD with scores of up to 3. The crop growth is mostly stunted, possibly due to the poor rainfall pattern.

2.1.2 Outcome 1.2: Effective seed systems improve access to quality seed by male and female farmers

Output 1.2.1: Early generation RTC seed production expanded

One of the biggest constraints to RTC productivity for smallholder farmers is the lack of access to reputable sources of disease-free certified seeds. There exists very little expertise in seed multiplication for RTCs among smallholder farmer within communities in Malawi, a challenge that has led to the sharing of diseased planting materials in the country through the informal (farm-saved) seed system. The RTC-ACTION project is working to support community-based RTC seed multipliers with early generation quality seed to multiply and exchange with their community members. To achieve this, the project is maintaining and establishing adequate early generation foundation seed in the screenhouse to feed into the certified seed multiplication programme. Table 13 summarises the activities on early generation RTC seed production expansion.

Potato. To improve access to quality seed potato among farming communities, RTC-ACTION engaged in a number of activities in the year which included production of pre-basic and basic seed potato. In 2017–18, 81,216 potato minitubers were harvested from aeroponics and 25,431 minitubers were harvested from sandponics, giving a total of 106,637 clean potato seed. This is an increase during the NCE, where initially 101,141 (Table 13) quality seed potato minitubers were produced under screenhouse conditions using both aeroponic (81,216) and sandponic (19,925) techniques during 2017–18.

Quality seed potato tubers of generation 0 (G0) and generation 1 (G1) seed potato were planted at Mbawa Research Station in Mzimba district to produce seed G1 and G2 in preparation for further multiplication for 2018 winter season.

Table 13. Summary activities for Output 1.2.1

Activity	Activity Indicator	Y2				Reasons for Deviations
		Milestones	Target	Actual	Achieved	
Produce pre-basic seed under screenhouse conditions for field multiplication	400,000 potato minitubers produced for 5 years	80,000 potato minitubers produced annually	80,000	106,637	133%	DARS provided one more screenhouse for sandponic tuber production
	400,000 potato minitubers produced for 5 years	80,000 potato minitubers produced annually	80,000	5,496		NCE period
	150,000 screenhouse SP vine cuttings by year 5	30,000 SP vine cuttings produced annually	30,000	54,000	180%	Due to screenhouse expansion
	5,000 cassava plants acclimatised by Y5	500 SH plants in Y2 and 3,500 in the final year acclimatised	500	84	17%	Reintroduction of cleaned plantlets from Nairobi is in process

Activity	Activity Indicator	Y2				Reasons for Deviations
		Milestones	Target	Actual	Achieved	
	Produce 10,000 cassava plants in the SH from indexed material	1,000 indexed cassava plants produced in Y2 and 3,000 each year	500	0	0%	Procurement of reagents is in progress
Establish and produce field grown early generation seed (EGS) produced through private-public partnerships	100 MT of early generation potato seed produced on 10 ha	20 MT of seed potato produced annually	20	77	385%	Due to increased ha on early generation potato seed production associated with high yield/ha
	100 MT of early generation potato seed produced on 10 ha	20 MT of seed potato produced annually	20	7.7		Harvested during NCE
		2 ha planted for early generation of seed annually (at DARS and by farmers/ private sector	2	3.6	180%	2 ha were planted to seed potato during summer and 1.6 ha during winter
		2 ha planted for EGS annually (at DARS and by farmers/private sector		1.5		Seed potato was planted during NCE period in preparation for 2018/19 season
	250,000 bundles of SP 15 ha of for vine production	50,000 bundles of SP vines produced annually	50,000	57,612	115%	Farmers expanded field sizes and farmers had more than one cutting
		3 ha for SP vine production annually	3	5	167%	More farmers became interested and were recruited
	10 ha for cassava seed multiplication	At least 1 ha of cassava seed multiplication established in Y1 and 3 ha in each following year	1	10	1000%	Established 10 ha for breeders seed
Expand private sector involvement (small to medium scale) in EGS production	6 private, EGS potato producers identified and trained in target areas	5 new private EGS potato producers identified and trained by the end of Y2	2	17	850%	Number increased as multipliers in each district were supposed to meet seed demand for target beneficiaries
		8 private SP vine enterprises	4	4	100%	

Activity	Activity Indicator	Y2				Reasons for Deviations
		Milestones	Target	Actual	Achieved	
		actively producing clean planting material				
		At least 10 ha under cassava seed multiplication established through private-public partnerships	10	10	100%	Target is 2 multipliers/ district. Lilongwe and Mzimba are divided into 2 districts, making 7 districts.
Support EGS potato storage	2 seed potato storage facility demo sites established and promoted	2 storage facilities constructed for demos	2	2	100%	Still in progress

In addition to the production of pre-basic seed under screenhouse conditions for field multiplication, there was also production of field-grown EGS through public–private partnerships which include individual or group of farmers and private companies. A total of 23 MT of clean seed potato were disseminated to 18 DSMs. Seed potato was produced based on cost-sharing approach where seed multiplier provided land and labour, and the project provided key inputs such as fertilizers and clean planting materials. This proved a useful approach in ensuring that each district is self-sufficient to meet its demand for target beneficiaries. During the year, 91.5 MT of improved potato varieties of 'Chuma', 'Mwai', 'Zikomo', 'Thandizo', 'Rosita', and 'Violet' were harvested from 9.5 ha; approximately 20 MT were disseminated to 9,345 target beneficiaries during summer cropping.

During the NCE, 7.7 MT of seed potato G1 and G2 for varieties 'Mwai', 'Violet', 'Thandizo', 'Zikomo', and 'Chuma' were harvested from 1.7 ha at Mbawa Research Station in Mzimba district, thus giving 99.2 MT of clean potato seed.

Low seed production at Mbawa Research Station was mainly due to erratic rainfall during January and February, when the crop had just started to produce tubers. Another important activity during this period was multiplication of EGS potato in readiness for dissemination to target beneficiaries during Y3. In this regard, 1.5 ha of seed potato were planted at Mbawa Research Station. Ten additional private farmers (DSMs) with an average land size of 0.2 ha in Dedza, Dowa, Ntchisi, Kasungu, Lilongwe East, Mzimba South, Mchinji, and Ntcheu have been engaged to produce seed potato, giving a total of 3.5 ha under seed potato multiplication across districts. Seed potato multiplication through commercial farmers is based on a cost-sharing approach, where seed multipliers have provided land and labour and the project provided fertilizers and clean planting materials. We envisage that each district will be self-sufficient in terms of seed potato to meet its demand for target beneficiaries.

In collaboration with front-line extension staff from the District Agricultural Development Office (DADO), 10,200 target beneficiaries were identified and registered in all districts. Of these, 9,993 received improved seed potato of the following varieties: 'Chuma', 'Mwai', 'Zikomo', 'Thandizo', 'Rosita', and 'Violet' (Table 14). Each beneficiary got 40 tubers of potato seed. Farmers were briefed

on recommended agronomic potato production practices during both registration and seed dissemination exercises in all districts.

Table 14. Number of target beneficiaries reached with seed potato

S/N	District	No. of Beneficiaries
1	Dedza	1,200
2	Lilongwe East	1,070
3	Lilongwe West	900
4	Mchinji	642
5	Mzimba South	1,199
6	Dowa	867
7	Ntchisi	903
8	Kasungu	1,012
9	Ntcheu	1,200
10	Thyolo	700
11	Neno	300
Total		**9,993**

Sweetpotato

Vine production. To ensure expansion of early generation of OFSP seed, screenhouse planting materials were produced by CIP and DARS, of which 540 bundles (54,000 cuttings) were disseminated to six (four males, 2 females) decentralised vine multipliers (DVMs) for further multiplication. What is more, old vine multipliers were strengthened to produce vines for the season to follow. After supporting production of high-quality planting by both new and old DVMs, the project worked to disseminate vines to project beneficiaries in both winter and summer cropping seasons of 2017–18 in 10 districts of the southern region. Beneficiaries were registered during dissemination (Fig. 19).

Figure 19. Beneficiaries receiving OFSP bundles (left) and signing for the bundles received (right).

Vine dissemination. Nsanje, Chikwawa, and some areas of Zomba were reached for winter cropping in 2017. Farmers in Nsanje and Chikwawa planted SP using residual moisture, whereas in Zomba production was under irrigation in schemes. An innovative way of dissemination was used whereby the "Mother–Baby" approach was used. During this period, 270 bundles were distributed to 45 Mother plot hosts and 10,320 bundles to 2,455 Baby plot hosts. This translates 10,590 bundles that were distributed to 2,500 beneficiaries during the winter season.

During the rainy season (2017–18), CIP and DARS disseminated vines in eight districts: Blantyre, Chiradzulu, Mulanje, Mwanza, Neno, Phalombe, Thyolo, and Zomba. A total of 792 bundles were distributed to 132 Mother plot hosts and 15,106 bundles to Baby plot hosts. Mother plot hosts received 6 bundles each, while Baby plot hosts received 1 bundle each. In total 15,898 bundles were distributed to 15,238 beneficiaries. In Chikwawa district, through CADECOM, 22 Mother plot hosts received 132 bundles (6 bundles each) and 1,000 Baby plot hosts received 2,000 bundles. Baby plots beneficiaries received 2 bundles each with the arrangement that in 2 months after planting, the farmers should pass on the seed to fellow farmers in their respective areas.

The RTC-Action project also disseminated vines to 300 nutrition care-group members in Ntonda EPA, Blantyre district for nutritional activities. CIP also distributed vines to 13 farmer groups (352 beneficiaries) in Blantyre, Mulanje, Mwanza, Nsanje, and Zomba districts for commercial roots production, where each received four bundles.

During the winter cropping season of 2018 (NCE), SP planting materials were distributed to farmers in Nsanje and Zomba districts targeting the EPAs where residual moisture and irrigation schemes are used. The five EPAs reached were Makhanga, Nyachilenda, and Zunde for Nsanje district, and Chingale and Likangala for Zomba district. Each Mother plot host beneficiary received six bundles (one of each six OFSP varieties), and the Baby plot host beneficiaries were reached with four bundles each. A total of 3,783 farmer beneficiaries and nutrition care-group members were reached with 15,132 bundles in Nsanje and Zomba (Table 15). Vines that were distributed were procured from DVMs who are supported by CIP (Table 16). In Nsanje the DVMs brought the vines to the distribution destination on their ox carts (Fig. 20). In some locations within Nsanje, farmers collected vines straight from the DVMs' field. On record, the Food and Agriculture Organisation od the United Nations (FAO) also distributed 20,000 vine bundles in Phalombe bought from Nankhwali fam, a vine multiplier backstopped by CIP. This makes a total of 35,132 vine bundles distributed to farmers during winter.

On record, CIP and partners distributed 94,490 vine bundles to beneficiaries during the reporting period. This translates to a land area coverage of 255.12 ha of OFSP production.

Table 15. OFSP vines disseminated during NCE period in Nsanje and Zomba districts

District	EPA	Beneficiaries Reached	Bundles per Beneficiary	Total OFSP Bundles Disseminated
Nsanje	Makhanga	1,000	4	4,000
	Nyachilenda	839	4	3,356
	Zunde—farmers	983	4	3,932
	Zunde—Care group	431	4	1,724
Zomba	Chingale—farmers	250	4	1,000
	Chingale—Care group	30	4	120
	Likangala	250	4	1,000
Total		**3,783**	**-**	**15,132**

Table 16. Vine Bundles that CIP procured from DVMs for winter distribution

DVM	District	# Bundles	Destination of Vines Delivered	
			EPA	District
Glenda Gomani	Blantyre	1,500	Makhanga and Chingale	Nsanje and Zomba
Daniel Mbebuwa	Mulanje	1,639	Nyachilenda	Nsanje
Kings Gadama	Blantyre	1,142	Makhanga and Zunde	Nsanje
Bridget Chiziko	Blantyre	1,513	Makhanga and Zunde	Nsanje
Stark Bophani	Blantyre	742	Makhanga and Zunde	Nsanje
Doreen Mankhwanda	Thyolo	2,033	Nyachilenda	Nsanje
Umodzi Sweetpotato Association	Nsanje	4,792	Zunde and Nyachilenda	Nsanje
Talandilidwa Club	Zomba	500	Chingale	Zomba
Maxwell Nkhoma	Zomba	1,293	Chingale and Likangala	Zomba
Total		**15,154**		

Figure 20. Farmers use an ox cart to deliver their vines at a distribution point.

CIP disseminated a total of 30,956 vine bundles in the winter and summer crop season of 2017–18 and 15,154 during the NCE period (2018 winter crop season). However, other NGOs and stakeholders disseminated 25,831 bundles in the 2017–18 summer crop season. As CIP supports Nankhwali farm in production of early generation and certified planting material, it linked Nankhwali to the FAO, who bought 20,000 vine bundles. Therefore, the total bundles of OFSP produced and disseminated by CIP, partners, and stakeholders was 91,941. At the plant population rate of 37,037 plants/ha, the number of bundles disseminated is enough to plant 248.24 ha of OFSP. This a combined total of 2017 winter, 2017–18 summer, and 2018 winter crop seasons.

Cassava

At least 1 ha of cassava seed multiplication established in Y1 and Y3 ha in each of the following years. To ensure the availability of clean EGS for the expansion of the private partnerships, the project has established 10 ha as on-station breeder and basic seed multiplication centres. The project exceeded its target because of the observed need to maintain more EGS to feed into the seed multiplication programme, to gradually move away from using no certified seeds during the first year.

During the NCE period, weeding was done in all seed multiplication fields at Chitedze and Mbawa. Additionally, security guards were hired and deployed at the multiplication site in order to safeguard against theft of roots and planting materials.

The project identified 15 potential seed multipliers, 13 males and 2 females. These were supported with planting materials as start-up capital for them to be established cassava seed multipliers. Most seed multipliers received planting materials in late January and, as such, planting was also done late (late January and February). During supervision it was noted that most fields were less than 1 ha, despite the fact that all farmers received 100–120 bundles which was enough to plant 1 ha. This was probably because most areas had already been allocated to other crops. Second, with extended storage periods, some planting materials were lost to dryness and hence not all were planted. Lilongwe and Kasungu had outstanding multiplication fields with good crop establishment and better management (Fig. 21).

*Figure 21. Fields of Mr. Chester Chirwa (*left*) in Kaluluma EPA, Kasungu, and Mr. Levison Variamu in Chitsime EPA, Lilongwe.*

Promotion and dissemination of new improved varieties among smallholder farmers. To enhance the adoption of improved cassava varieties, the project disseminated released cassava varieties (Fig. 22). A total of 40,023 bundles of seed for improved cassava varieties were procured between January and February 2018 for distribution to 13,341 HH. However, the total number of farmers whose data have been successfully captured in RTC-ACTION data files is 11,017 (Table 17). This is due to the slow turnover of data from distribution centres by extension partners, reception of more than three bundles per farmer, particularly in Nkhatabay, and non-collection of bundles from distribution centres by farmers in Lilongwe due to the dry spells. Once all outstanding data are turned over, the figure will be updated. At the seed rate of 65 bundles/ha, the amount of cassava cuttings disseminated in 2017–18 are enough for 615.73 ha of cassava of improved varieties and planted with high-quality seed material. At an average root yield of 20 MT/ha, this translates to a total cassava production of 12,314 MT in Y2.

Figure 22. Highlights of the seed distribution exercise.

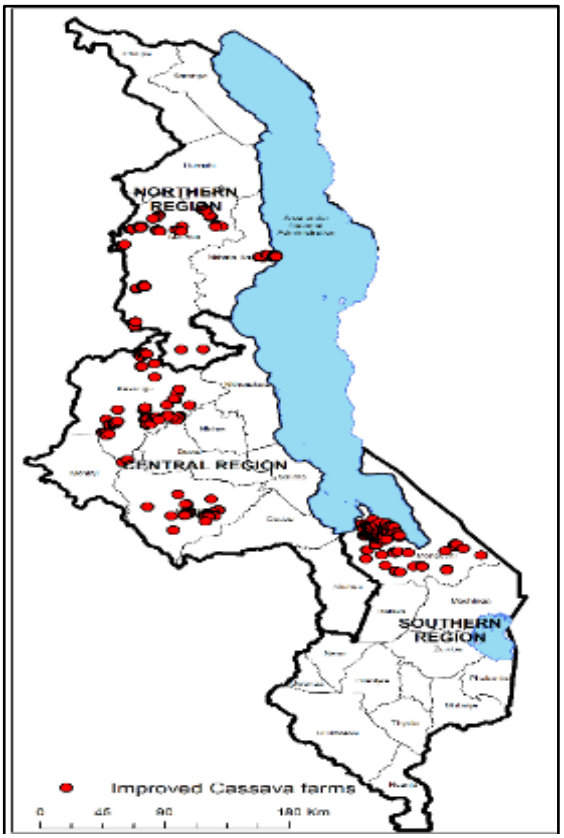

Figure 23. Distribution of multiplications of improved clean planting materials in 20 EPAs visited during NCE.

During the NCE period, the extension staff in the targeted districts visited farmers who received planting materials and collected Global Positioning System coordinates of each field. Figure 23 shows the locations of farmers in 20 EPAs of each district that have been visited. The data entry is continuing, and a final map will be finalised and reported.

Table 17. Progress of the distribution of cassava bundles in all RTC-ACTION project mandate districts

District	Bundles	Beneficiaries (as of 31/03/2018)	Expected No. of Beneficiaries	Achievement	Remarks
Kasungu	6,000	1,949	2,000	97%	Data for 51 farmers not yet submitted by extension agents (EAs).
Lilongwe East	5,285	875	1,762	50%	Recovery of distribution forms from EAs has been slow.
Lilongwe West	4,492	1,055	1,497	70%	Did not collect cuttings due to dry spell in January 2018.
Mzimba North	6,061	1,936	2,020	96%	Data for 84 farmers not yet submitted to IITA by EAs.
Mzimba South	6,000	1,621	2,000	81%	Data for 379 farmers not yet submitted to IITA by EAs.
Nkhata Bay	6,000	1,520	2,000	76%	Some farmers got more than 3 bundles affecting target.
Mangochi	6,185	2,061	2,061	100%	Done
Total	**40,023**	**11,017**	**13,341**	**81.5%**	

Output 1.2.2 Onward decentralised multiplication networks expanded

The RTC-ACTION project's hopes for the successful establishment of a sustainable seed system based on the success of the seed multipliers model was initiated. Multipliers are recruited and supported by the project with technical expertise through training in seed production and linkages to regular advisory services and potential markets. Table 18 summarises the decentralised multipliers networks.

Table 18. Summary of Output 1.2.2

Activity	Activity Indicator	Milestones	Target	Actual	Achieved	Reasons for Deviation
Conduct community awareness meetings to identify potential seed multipliers in new operational areas	Awareness and sensitisation of farmers to produce RTC seed	Expression of interest in seed potato, OFSP, and cassava production 1 advert and 1 radio programme released within 6 months	1	1	100%	Sensitisation was done during the launch of Madyo biscuit at Chinakanaka market in Mulanje and National Agriculture fair in Blantyre; flyers were distributed. Journalists from radio stations aired the activities. Extension staff were tasked to identify potential seed multipliers.
		At least 1 meeting per district (potato)	17	17	100%	Meetings were done at EPA level to DADO staff who scaled down the meetings to community level.
		At least 1 meeting per SP vine production sensitisation meetings completed by the end of Y2	1	1	100%	These were done before vine dissemination, where sensitisation started at district then scaled down to communities; 1 per each district
	At least 5 sensitisation meetings for potato, SP, & cassava seed multiplication completed by Y2	At least 1 meeting per district for cassava seed production sensitisation meetings completed by the end of Y2	21	22	105%	
Train decentralised multipliers on seed/vine production and business plans	5 trainings held in seed potato	1 training in seed potato production conducted annually	10	10	100%	
	5 trainings held in SP	1 training in SP vine multiplication conducted annually	1	1	100%	
	Vine production	1 training conducted annually	25	25	100%	
		1 training in cassava seeds production annually (10 seeds multipliers)	10	10	100%	
Identify suitable sites for seed/vine	No. of sites sampled and analysed for potato diseases	Cropping history completed for 10 sites by end of Y1	10	17	170%	

Activity	Activity Indicator	Milestones	Target	Actual	Achieved	Reasons for Deviation
production	No. of sites with sufficient water for vine production	At least 15 sites for SP multiplication identified	10	15	150%	Farmers requesting to be supported for vine multiplication.
		At least 40 sites identified for cassava seed production by end of the project	10	15	150%	Target was 2 seed multipliers per district. Since Lilongwe and Mzimba are divided into 2 districts each, we now have 7 instead of 5 districts as planned. 15 sites were identified.
Support decentralised multipliers to invest in seed storage	10 seed potato diffused light stores (DLS) promoted	2 DLS supported annually for potato	2	6	300%	All seed potato multipliers were encouraged to construct storage structures to ensure good quality seed

Potato. To deliver on this output under potato, the following activities were implemented:

- Community awareness meetings
- Training of DSMs
- Identification of sites for seed potato production
- Construction of seed storage structures
- Dissemination of improved seed potato to target beneficiaries

The community awareness meetings were conducted in new operational areas such as Dowa, Kasungu, and Lilongwe to brief farmers on objectives of RTC-ACTION and to identify potential seed multipliers. Key parameters used for identification of sites included cropping history, accessibility, and availability of water. Just as with other key activities, this one was conducted jointly with front-line extension staff from the DADO. Nine community awareness meetings were conducted in all districts except for Thyolo to sensitise potential farmers on minimum requirements for seed potato multiplication. Following these meetings, 17 potential seed multipliers who were either individuals or groups of farmers were identified and trained on seed potato production through 10 training sessions held across districts.

The project also encourages seed multipliers to construct seed storage structures to ensure that quality seed potato is disseminated to beneficiaries. In this regard, six small-scale DLS were constructed in Ntcheu, Mzimba South, Ntchisi, and Lilongwe. One new DLS was also constructed at Tsangano Sub-Research Station to ensure that seed potato for on-station trials and OFTs around Tsangano is properly handled. On a similar note, DLS structure at Bembeke Sub-Research Station went through maintenance during this reporting period.

Sweetpotato

Community awareness meetings to identify potential seed multipliers in new operational areas. CIP participated in district executive community and district executive agriculture community meetings in the various districts (Table 19). During these meetings CIP made a presentation and introduced the RTC-Action Malawi project to the district council, highlighting the objectives of the project in the districts where the project is being implemented. Following these high-level district meetings, CIP and DARS conducted planning meetings with districts extension

staff where DADOs, agriculture extension development coordinators (AEDCs), crops officers, agriculture extension development officers (AEDOs), districts food and nutrition officers, and education officers participated. The objective of these meetings was to plan for agricultural, nutritional, and marketing activities that are being implemented under the SP component in specific EPAs and sections within the targeted districts for the 2017–18 cropping season. To ensure that smallholder farmers were reached with the programme, AEDOs responsible for targeted sections within EPAs scaled down the meetings to communities. During these meetings, farmers were sensitised on SP vines multiplication and roots production practices.

Table 19. Participants during district meetings that CIP and DARS conducted and/or participated in

Meeting	District	Female Participants	Male Participants	Total
District Executive Community	Mulanje	23	50	**73**
	Mwanza	11	28	**39**
	Neno	57	49	**106**
	Subtotal			**218**
District Executive Agriculture Community	Chiradzulu	14	21	**35**
	Nsanje	11	32	**43**
			Subtotal	***78***
Activities—review and planning	Blantyre	13	14	**27**
	Mulanje	8	13	**21**
	Phalombe	5	11	**16**
	Chiradzulu	5	8	**13**
	Zomba	12	15	**27**
	Subtotal			***104***
	Grand total			**302**

Another awareness meeting was convened by WHH seed multipliers sensitisation in Chikwawa. CIP participated in a seed multiplication sensitisation meeting that was organised by WHH at Hope Lodge in Chikwawa district; 58 people (27 females, 31 males) participated. Government extension staff, lead farmers, and executive members for the Water Users Association of Kasisi irrigation scheme project also attended. The RTC-Action project manager helped to facilitate a discussion on seed multiplication for SP (Fig. 24). She took the discussion to a more interactive approach by creating a platform to discuss opportunities and challenges along the SP VCs in Chikwawa. In collaboration with CIP, WHH will provide planting materials for seed production in the irrigation scheme, and CIP will provide the technologies. An agreement on the way forward has already been signed.

Figure 24. RTC-ACTION project manager (Felistus Chipungu) facilitates a discussion on seed multiplication during the meeting at Hope Lodge in Chikwawa district.

Training of community development assistants (CDAs), AEDCs, AEDOs, and lead farmers in agronomic practices. CIP and DARS facilitated 3 weeks of training that was conducted by United

Purpose (DIVERSIFY project). A total of 103 participants from Balaka, Chiradzulu, and Thyolo (Luchenza) were trained in OFSP agronomic practices (Table 20).

Table 20. Participants for OFSP agronomic practices from Balaka, Chiradzulu and Luchenza

Participants Category	Males	Females	Total Participants
DAES staff	44	16	60
Lead farmers	22	12	34
CDAs	7	2	9
Total	**73**	**30**	**103**

Cassava

The project plans to conduct sensitisation meetings with district agricultural personnel in each of the targeted cassava districts to harmonise knowledge and expectations on the technical support that the project seeks from the local EAs. Additionally, the project sought to formally train the EAs in cassava production management and seed certification standards. The formal trainings were also extended to the district horticulture officers who act as an uplink support line for the EAs with direct contact to technical officers at IITA and DARS. Twenty-five AEOs and district horticulture officers (18 males, 7 females) were trained in cassava seed production practices. The EAs were drawn from EPAs where the RTC-ACTION project has established seed multiplication fields with smallholder farmers, with the intention of imparting seed production knowledge to the EAs so that they can act as a local source of advice and information for the farmers. The training covered all aspects of cassava production, including crop husbandry, identification of pests and diseases, business planning and recordkeeping, and the seed certification scheme for cassava which is currently enforced by the Seed Service Unit (SSU). This activity was conducted on February 28th–March 1st 2018, at the Simama Hotel in Lilongwe. The target for the activity to train 25 technicians was successfully accomplished. The training attracted 28% participation by female technicians. The attendance list for the training is presented in Table 21.

Table 21. Cassava seed multipliers at the 2017/18 seed production training held at Simama Hotel

Name	Gender	District	EPA	Position
Albert Makumba	M	Lilongwe	LL West	Crops Officer
Maria Kang'ombe	F	Lilongwe	LL East	Crops Officer
Annie Kashitingu	M	Lilongwe	LL East	AEDO
Peter Watson	M	Lilongwe	LL East	AEDO
Cosmas Chikapa	M	Nkhatabay	Nkhatabay	Horticulture Officer
Mariam Nkhoma	F	Mzimba	Mzimba North	AEDC
Fred Manyozo	M	Mzimba	Mzimba North	Horticulture Officer
Lytwell Nyirenda	M	Nkhatabay	Nkhatabay	AEDO
Vannex Chitetet	M	Kasungu	Mkanakhoti	AEDO
Lerwick Zimba	M	Kasungu	Kaluluma	Horticulture Officer
Chrissie Msowoya	F	Nkhatabay	Chintheche	AEDO
Roseline Tweya	F	Mzimba	Mpherembe	AEDO
Zakeyo Banda	M	Kasungu	Kaluluma	AEDC
Andrew Mmmango	M	Mangochi	Mbwadzulu	AEDO
Albert Nyirenda	M	Mzimba South	Luwelezi	AEDO
Chrissy Phiri	F	Mzimba South	Kazomba	AEDO
Ndaonga Chipeta	F	Lilongwe	Ngwangwa	AEDO
John Mphaya	M	Lilongwe	Chitedze Research	Horticulture Officer

Name	Gender	District	EPA	Position
Yohane Kaniye	M	Lilongwe	Chitedze Research	Research Attendant
Silence Muwanje	M	Lilongwe	Chitedze Research	Technician
Melody Manase	M	Mangochi	Katuri	AEDO
Daudi Katoma	M	Mangochi	Katuri	AEDC
Lingston Namaponya	M	Mangochi	Mangochi	Horticulture Officer
Harvey Horrea	M	Lilongwe	Lilongwe	Horticulture Officer
Fanny Kanyenda	F	Lilongwe	Lilongwe	AEDO

To maintain high-quality seed that the project delivers to its farmers, we identified a need to train all seed multipliers under the project in seed production in accordance with Malawi's seed certification scheme enforced by the SSU of DARS. This training was held concurrently with that of the 25 technicians described above. Two farmers were identified for training from each of the seven districts under RTC, except Mangochi and Lilongwe West, which had three farmers each. This activity was conducted on February 28th–March 1st 2018, also at the Simama Hotel in Lilongwe (Fig. 25). Sixteen seed multipliers were trained, exceeded the target of 10 (a 160% over-achievement). This was necessary because we found that it was important to train all farmers who benefitted from seed under activity 1.2.1.

Figure 25. Agricultural and farmer participants at the training.

Conduct community awareness meetings to identify potential seed multipliers. During the NCE period, more community awareness meetings were conducted in cassava project target districts. The meetings were facilitated by scientist and/or technicians from the RTC programme of DARS. The AEDCs and AEDOs were involved in mobilising farmers for the training (Figs. 26 and 27). In each EPA farmers were drawn from different constituent sections alongside their extension workers (AEDOs). Twenty-seven meetings were held in seven RTC operating districts of the country, reaching out to 811 farmers (255 females, 556 males; Table 22).

Figure 26. Farmers attend a cassava disease identification practical training in Mzimba.

Figure 27. Farmers attend a cassava disease identification practical training in Mzimba (left) and Mangochi (right).

Table 22. Attendees at the awareness meeting in all seven RTC-ACTION mandate districts

District	EPA	M	F	Total	District	EPA	M	F	Total
Lilongwe East	Mkwinda	16	3	**19**	Mzimba South	Vibangalala	21	3	**24**
	Mtundu	15	7	**22**		Emfeni	19	5	**24**
	Chitsime	16	8	**24**		Manyamula	33	6	**39**
	Nyanja	14	6	**20**		Mbawa	15	4	**19**
Lilongwe West	Mpingu	17	5	**22**	Mzimba North	Zombwe	21	11	**32**
	Chileka	13	13	**26**		Mpherembe	22	11	**33**
	Ukwe	42	9	**52**	Nkhatabay	Mpamba	17	16	**33**
	Chigonthi	24	2	**26**		Chintheche	22	18	**40**
	Mgwangwa	29	5	**34**		Tukombo	23	14	**37**
Kasungu	Mtunthama	12	8	**20**		Nkhatabay	21	22	**33**
	Kaluluma	14	6	**20**	Mangochi	Nankumba	27	11	**38**
	Mkanakhoti	15	5	**20**		Nasenga	30	16	**46**
	Santhe	17	5	**22**		Katuli	23	16	**39**
						Mbwadzulu	18	20	**38**
Total							**556**	**255**	**811**

Farmers trained by extension workers on cassava management. This was the follow-up activity to the training of trainers (ToT) activity that was done in the last quarter of Y2 of the project. IITA had trained 70 AEDOs in good cassava production practices and each was supposed to train 200 farmers in his/her area to reach a target of 14,000 farmers in the project targeted zones. These trainings were conducted at field level, led by the AEDOs and supervised by IITA and the AEDCs. The trainings commenced on June 5th 2018, and were completed on June 22nd. In total, 335 trainings were conducted in the seven districts, attended by 13,320 farmers (Table 23).

Table 23. Number of participants to RTC-ACTION trainings on cassava husbandry practices.

District	No. of EPAs	No. of Trainings	No. of Farmers Trained
Mzimba North	8	45	1,800
Mzimba South	3	40	1,600
Nkhata Bay	5	50	2,000
Kasungu	5	50	2,000
Lilongwe East	2	50	2,000
Lilongwe West	2	50	2,000
Mangochi	3	50	1,920
Total	**28**	**335**	**13,320**

Output 1.2.3 Seed quality control standards implemented

Part of the technology support package to the seed multipliers is seed inspection and certification to ensure quality seeds. The project is therefore facilitating registration, inspection, and training of seed inspectors on use of the standards which the project contributed to developing (Table 24).

Table 24. Summary of Output 1.2.3

Activity	Activity Indicator	Milestones	Target	Actual	Achieved	Reasons for Deviation
Validate and update standards and protocols for seed/vine quality control	Inspection standards validated	3 inspections completed in rainy-season potato production annually	3	3	100%	
		3 inspections completed in dry-season potato production annually	3	3	100%	Inspections conducted at vegetative stage and during harvesting
		3 inspections done during NCE	3	3	100%	All fields qualified
		3 SP inspections in dry/rainy season	3	2	67%	Inspections were done before vine cuttings for winter and summer distribution.
		1 round of vine inspections to farmers during NCE	1	1	100%	
		1 inspection done on 10 cassava seed multiplications fields	1	1	100%	
	3 trainings held	1 training of at least 15 inspectors	1	1	100%	

Potato. CIP facilitated the registration and inspection of all seed potato fields, achieving 100%. During this reporting year, 21 seed potato multipliers, including Mbawa Research Station, were inspected. We are glad to report that all seed potato was declared clean and suitable for further multiplication. Crop inspections were done at vegetative stage and during harvesting. During the NCE, CIP facilitated the inspection of all 3 seed potato multipliers, including Mbawa Research Station, at harvest. All seed potato too was declared clean and suitable for further multiplication.

Sweetpotato

CIP facilitated registration of OFSP seed multipliers with SSU prior to inspections. A total of 25 DVMs (20 males, 5 females) and three clubs were registered and inspected by the SSU prior to vine harvest for the 2017–18 cropping season (Figs. 28–30).

Figure 28. Seed inspection at DVMs field by DAR-SSU seed inspector.

Figure 29. Sample of inspection report issued by the seed inspector for the seed multiplier.

Figure 30. Seed inspector issuing a report to a DVM after field observations.

Validate and update standards and protocols for seed/vine quality control. Potato and SP standards have been developed and are being validated by the seed inspectors

Registration of seed multipliers with the SSU. During the NCE CIP facilitated the registration of seed multipliers for the 2018–19 growing season. A total of 47 (40 males, 7 females) and one club of seed multipliers (9 males, 9 females) have been registered and are ready for inspections (Table 25). Out of the 47 seed multipliers registered, 46 paid registration fees by themselves. Thus, CIP is empowering multipliers by encouraging registration with the SSU.

Table 25. Registered vine multipliers for dry season vine production (2018)

No.	District	EPA	Farmer	No.	District	EPA	Farmer
1	Blantyre	Ntonda	Bridget Chiziko	25	Chikwawa	Mitole	Exford Dimo
2	Blantyre	Soche	Glenda Gomani	26	Chikwawa	Mitole	Enock Nsabwe
3	Blantyre	Soche	Kings Gadama	27	Chikwawa	Mitole	Ronald John
4	Blantyre	Lunzu	Mzee Chapweteka	28	Chikwawa	Mitole	Martin Gauti
5	Chikwawa	Livunzu	Bottoman Nazalio	29	Chikwawa	Mitole	Robert Greysan
6	Chikwawa	Livunzu	Jack Faiti	30	Chikwawa	Mitole	Robert Makyoli
7	Chikwawa	Livunzu	Zyuwawu Luwizhi	31	Chikwawa	Mitole	Chrissie John
8	Chikwawa	Livunzu	Kenedy Followadi	32	Chikwawa	Mitole	H Katsabola
9	Chikwawa	Livunzu	Simon Thaphanya	33	Mulanje	Chinyama	Daniel Mbebuwa
10	Chikwawa	Livunzu	T Alumando	34	Neno	Neno	Jonasi Goliati
11	Chikwawa	Livunzu	Elizaberth Chilomo	35	Nsanje	Nyachilenda	Zex Thikiti
12	Chikwawa	Livunzu	Frighton Phompho	36	Nsanje	Zunde	Nelson Nyadaufe
13	Chikwawa	Livunzu	Laston Mzukuya	37	Nsanje	Nyachilenda	Hussein Hamuza
14	Chikwawa	Mbewe	Tarsizio Kiti	38	Nsanje	Nyachilenda	Petro David
15	Chikwawa	Mbewe	William Gilbati	39	Nsanje	Zunde	Gerald Action
16	Chikwawa	Mbewe	Lameck Pensulo	40	Nsanje	Nyachilenda	David Witman
17	Chikwawa	Mbewe	Felista Juma	41	Nsanje	Nyachilenda	Aida Lopa
18	Chikwawa	Mbewe	Nelio Khembo	42	Nsanje	Nyachilenda	Isaac Mpunga
19	Chikwawa	Mitole	Robert Greyson	43	Nsanje	Nyachilenda	H. Masiyamphoka
20	Chikwawa	Mitole	Martin Gauti	44	Nsanje	Nyachilenda	George Keneth
21	Chikwawa	Mitole	Ronald John	45	Thyolo	Dwale	Annie Mazulu
22	Chikwawa	Mitole	Notcha Andrew	46	Thyolo	Dwale	Masambiro Jenda
23	Chikwawa	Mitole	Francis Limited	47	Zomba	Chingale	Talandilidwa Club
24	Chikwawa	Mitole	Michael Chinkhali	48	Zomba	Thondwe	Maxwell Nkhoma

Train inspectors on seed/vine production and quality control–para-seed inspectors trained. Para-seed inspectors were trained on April 16th–19th, 2018, at Mapiri Lodge in Dedza district; 51 people participated. The meeting was conducted by RTCDT and facilitated by the RTCs technical teams from CIP, IITA, DARS, and SSU. The objectives of the meeting were to:

- Train and licence officers from DAES, who have been tasked to help SSU in implementation of seed standards and certification for RTCs
- Highlight the seed production and certification procedures for RTCs
- Discuss and agree on mode of operation to be used for efficient implementation
- Remind existing para-seed inspectors on laws governing seed certification and quality control.

The training lasted 4 days with theory and field practical components. The participants had a field-learning journey to SP and potato fields in Dedza district, and to Salima, Chitala for cassava (Fig. 31). Yams, coco-yams, and Livingstone potato also fall into the RTC category and soon standards will be developed.

Figure 31. Practical time in potato (left), SP (middle) in Dedza, and cassava in Salima (right).

Cassava. For most of these farmers this was their first time to be involved in a formal seed production scheme. Thus the project decided to support them with registration and inspection processes and costs incurred with the SSU. RTC-ACTION also needed to hold trainings for the government's seed inspectors on the recently adopted seed standards. This is because most of the inspectors had no prior formal training in seed certification, especially the technical identification of different cassava varieties and symptoms of cassava diseases and pests of major importance. To ensure that the seed produced under the project meets the quality standards, all 15 cassava seed multipliers supported by the project have been registered with SSU as required. Most farmers planted in late January and early February, as such by the end of March the crop was not fully established. Plans to conduct the first seed inspection are underway and will be done by the end of April 2018. In all, 15 seed inspectors (12 males, 3 females) were trained on cassava variety identification, pests and disease identification, and seed certification standards and procedures in Salima from March 18th–21st 2018 (Fig. 32). The inspectors came from Lunyangwa, Bvumbwe and Chitedze

Figure 32. Participants of the seed inspection training in Salima.

research stations of DARS. The training involved theory and practice on disease and pest identification and sampling procedures.

Output 1.2.5 Improved seed management by farmers

Clearly, there are vast knowledge gaps between official government recommendations and farmers' practice for RTC production and management. These knowledge gaps significantly affect productivity of farmers' fields. For example, most farmers cannot identify the early symptoms of common pests and diseases that need to be controlled before they spread to the whole field and affect yields. These obvious knowledge gaps pose a threat to the project's deliverables on productivity. Table 26 summarises the project's improved seed management activities.

Table 26. Summary of Output 1.2.5

Activity	Activity Indicator	Year 2			Reasons for Deviations
		Target	Actual	Achieved	
Extension staff and farmers trained on techniques for on-farm seed	2 TOTs on cassava seed management	70	77	101%	77 extension staff (ToTs) trained on cassava seed management.
	Each ToT train 200 farmers	200	200	100%	At least 200 farmers trained on cassava. It is still in progress .
	11 potato district ToT sessions	150	268	167%	Successfully implemented
		2,000	2,258	113%	Farmers were trained during establishment of demo plots and also during field days.
	10 SP district ToT sessions	100	145	145%	Trained on all aspects of vine and root production, including pests and disease management and control.
	# of field days held	20	17	85%	Mother plots were used as demo plots at 1 to 100 ratio. In 8 districts, 17 EPAs there are 132 Mother plots. Nsanje field days yet to be done.
		30	34	113%	The activity was conducted successfully, but prolonged dry spells in some areas have worsened performance of the varieties.
		10	22	110%	1 potato field day conducted per district annually
	100 cassava demo plots mounted	35	30	86%	30 demo plots have been established; however, dry spells affected the planting of demos in other places.

Potato. The project implemented a number of key activities, including trainings for the front-line extension staff in the Ministry of Agriculture, Irrigation and Water Development and establishment of on-farm seed improvement demo plots. As presented in Table 27, 268 staff (172 males, 96 females) against a target of 150 were trained on techniques for on-farm seed improvement, which include positive and negative seed selection and small-plot approach (Fig. 33). Other equally important topics covered during this ToT were site selection for potato production and seed storage. Extension staff were supposed to train farmers in their respective

Figure 33. Field practical on potato seed selection techniques in Chamama Section in Kasungu district.

districts, which was successfully implemented through establishment of potato demo sites and field days.

Table 27. Number of extension staff trained on potato production

District	Attendance by Gender		Total
	Male	Female	
Dedza	13	14	**27**
Lilongwe East	12	18	**30**
Lilongwe West	17	15	**32**
Ntcheu	21	4	**25**
Ntchisi	24	9	**33**
Mchinji	22	6	**28**
Mzimba South	29	5	**34**
Dowa	18	16	**34**
Kasungu	16	9	**25**
Total	**172**	**96**	**268**

Field days are important activity in promoting new technologies as they give farmers an opportunity to provide feedback on the performance of the new varieties. Field days were organised in collaboration with DADO staff and were conducted at selected demo sites in selected districts. This exercise was held at vegetative stage to enable farmers to learn morphological differences among varieties and to identify key pests and diseases for potato crop. A total of 22 field days were conducted in Dedza, Ntcheu, Mzimba South, Ntchisi, and Lilongwe, where 2258 farmers (1,138 males, 1,120 females) were trained in all aspects of potato production.

During the NCE period, 19 seed potato demo plots planted during the 2017–18 rainy season were harvested. Farmers from around the plots were invited during harvesting exercises in all districts to be trained on seed management at harvesting all the way to storage facilities.

Sweetpotato

To ensure that seed multiplication procedures are well practiced for quality OFSP planting materials, a training was conducted in Lunzu, Blantyre for seed multipliers where 20 DVMs (10 males, 10 females) from 6 districts participated. An agribusiness officer from Blantyre Agriculture Division trained the multipliers on the business of vine production. A field tour (Fig. 34) was organised to augment issues that were covered during the training sessions.

Figure 34. OFSP vine multipliers on a field tour at DVM Henry Ngwalo in Chiradzulu district, Mombezi EPA.

CIP and DARS also conducted sweetpotato seed multiplication and roots production trainings for district extension staff in the 10 OFSP districts (Table 28).

Table 28. District participants during sweetpotato training

District	No. of Participants by Position					Participants		
	DADO	Crops Officer	AEDC	AEDO	Field Officer (CADECOM)	Total	M	F
Blantyre	0	1	1	10	0	**12**	8	4
Chiradzulu	0	1	2	10	0	**13**	7	6
Chikwawa	1	1	2	10	2	**16**	13	3
Mulanje	0	0	3	18	0	**21**	11	10
Mwanza	1	1	2	5	0	**9**	7	2
Neno	0	1	1	5	0	**7**	5	2
Nsanje	0	0	3	15	0	**18**	14	4
Phalombe	0	1	1	9	0	**11**	8	3
Thyolo	0	1	2	10	0	**13**	8	5
Zomba	1	0	4	20	0	**25**	16	9
Total	**3**	**7**	**21**	**112**	**2**	**145**	**97**	**48**

Demo (Mother) plots were planted and harvested in summer and winter of 2016–17. In general, performance was high under residual moisture in Chikwawa and Nsanje, where the variety 'Mathuthu' provided the highest yield (45.5 MT/ha, Table 29). This is expected as there are no dry spells during the course of plant growth under residual moisture, unlike in rain-fed crop production. Results were poorest in Neno, with 13.54 MT/ha as highest yield for variety 'Zondeni'. There is need to put more effort to improve yields in Neno, including testing of new lines. Given this performance, farmers may wish to choose varieties of preference based on yields and taste, which was also done during cooking demos. The national average (2017) for SP is 20 MT/ha. The average performance of some varieties—'Anaakwanire' (24.73 MT/ha) and 'Kadyaubwere' (21.65 MT/ha)—were above. Yields of 'Chipika' and 'Kaphulira' were similar to the national average (Table 29, Fig. 35).

Table 29. OFSP variety yields achieved under demos against potential yields for 2017/18

District	Anaakwanire	Chipika	Kadyaubwerere	Kaphulira	Mathuthu	Zondeni
Chikwawa	42.33	35.98	41.27	37.04	45.50	
Chiradzulu	19.56	11.01	21.90	20.11	18.07	13.97
Mulanje	34.71	29.21	17.95	22.53	9.80	
Mwanza	10.58	8.99	12.70	10.58	10.58	6.14
Neno		3.70	3.92	5.19	5.40	13.54
Nsanje	29.63	15.56	41.59	27.83	31.11	23.92
Phalombe	18.52	39.64	27.79	29.42	11.53	4.44
Thyolo	12.70	15.66	8.15	9.74	5.82	
Zomba	29.84	21.38	19.58	20.69	9.31	25.61
Average	**24.73**	**20.12**	**21.65**	**20.35**	**16.35**	**14.60**

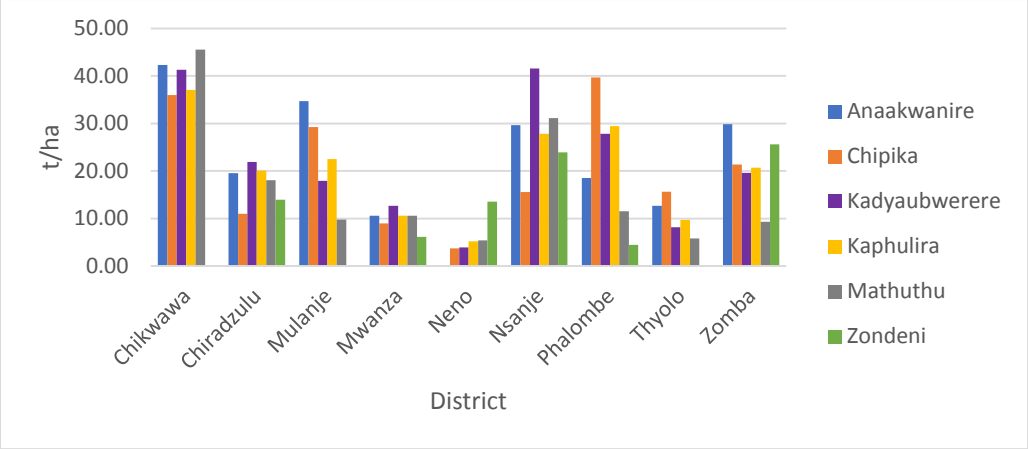

Figure 35. Yield of OFSP (MT/ha) by variety per district.

During demo plot harvesting, farmers were trained on utilisation of OFSP to produce homemade products such as doughnuts, juice, porridge, and 'mandazi' as well as preparing a one-pot dish of OFSP with vegetables/meat/ fish as family meals.

Further, CIP has a working agreement with a youth organisation, YAED, who in collaboration with DAES staff of Mbulumbuzi EPA, Chiradzulu district facilitated the training of YAED members. Nineteen youths and two DAES staff participated. During the training YAED members benefited from vines (Fig. 36).

Figure 36. YAED members benefited from OFSP vines to plant for roots production.

Ten seed multipliers (7 males, 3 females) from Nsanje district were given an opportunity to visit Bvumbwe Research Station. This was a Concern World Wide (CWW) initiative to enhance farmers' knowledge on OFSP seed system. The objective of the tour was to take the farmers through the process of seed multiplication, from TC lab, screenhouse (Fig. 37), to the open field for them to appreciate the process. They also visited two DVMs' fields, to Mombezi EPA, Chiradzulu district (at Henry Ngwalo), and Mulanje Boma EPA, (Nankhwali farm).

Figure 37. Farmers from Nsanje appreciating OFSP production in the screenhouse at Bvumbwe Research Station.

Field days/Mother plots harvest. Field days were conducted in all the 10 districts where RTC-ACTION is implementing its SP activities. During these field days, Mother plots were harvested for demos and yield data were collected from the same plots. Cooking demos were also conducted during the field days, where different products were prepared following different recipes that were prepared by the nutrition team. Before harvesting started, the farmers were sensitised on the harvesting practices that were to be followed (Figs. 38 and 39).

Figure 38. CIP research technician sensitizing farmers on the harvesting process to be followed.


Figure 39. Harvesting of SP in Zomba, Thondwe EPA (left) and Blantyre, Ntonda EPA (right).

Cassava

Seventy-seven extension staff (ToTs) were trained on cassava seed management (Fig. 40). The major objective of this activity was to build the capacity in AEDOs and their supervisors AEDCs and crops/horticultural officers on good cassava production and seed multiplication practices. They would then return to their respective areas to impart the acquired knowledge to farmers, especially those in areas where cassava-planting materials were distributed by the RTC-ACTION project in 2017–18. The training involved classroom presentations/discussions and practicals on disease and pest identification and management. The practicals gave the participants the chance to relate the knowledge gained in the classroom to the field situation, especially on disease and pest symptoms. This was further strengthened through the screening of a DVD on CBSD from East Africa (i.e. 'CBSD: A New Outbreak of this Disease in the Lake Zone of Tanzania'). A total of 77 participants (61 males, 26 females) from the RTC-ACTION (cassava) project districts of Mangochi, Lilongwe West, Lilongwe East, Kasungu, Mzimba South, Mzimba North, and Nkhata Bay attended.

Figure 40. Participants at the ToT in Salima (two groups were trained in two sessions).

Establishment of on-farm seed demo plots and farmers' field days. Under this activity, the project plan was to establish 35 demo plots in the seven cassava mandate districts (each district hosting 5 demos). These demos were to act as cassava production learning centres for farmer communities surrounding the EPAs where the project is working. Additionally, they would serve as practical session points for the 70 EAs trained through Output 1.2.5, who are supposed to train up to 200 farmers each after the ToT. In this regard, 39 demos were established in the seven cassava mandate zones, 36 demos were established by DARS, and 3 were established by IITA. One farmers' field day was conducted on March 9th 2018, on one of the demo sites in M'bwatalika in Lilongwe district. It attracted 150 farmers from the surrounding villages, including the local traditional authority T/A M'bwatalika (Fig. 41). The farmers were exposed to three new varieties of cassava which they were not aware of. Cassava products were also displayed and their uses, including fermented cassava flour, high-quality cassava flour, cassava crisps, and a yellow root cassava variety 'Chamandanda'.

Figure 41. Highlight of RTC-ACTION project staff sharing cassava production tips to a section of the field day attendees.

Output 1.3.1 Viable options for soil fertility improvement tested and promoted

On average RTC yields in Malawi fall short of the crop's potential. One factor attributed to this is the marginalised soils to which the crop is subjected in Malawi. It has been hypothesised that RTC yields can improve with soil amendments with inorganic fertilizer. However, the optimum combination of these fertilizers for maximum and cost-effective yield response has not yet been determined with empirical data. Table 30 provides soil fertility activities on SP and cassava.

Table 30. Summary progress of Output 1.3.1

Activity	Activity Indicator	Milestones	Target	Actual	% Achieved	Reasons for Deviation
Design and evaluate fertilizer combinations (organic/inorganic)	No. of fertilizer research trials conducted by crop	At least 1 OFSP trial each year (Y2–Y4)	1	1	100%	1 trial set on fertilizer blend for improved OFSP productivity.
		At least 1 cassava trial each year (Y2–Y4)	1	1	100%	1 fertilizer trial for improved cassava production in 4 sites.

At least one fertilizer combination trial conducted per crop each year

Sweetpotato. As SP is progressing towards commercialisation, there is need to maximise yields per unit area. A fertilizer trial is being conducted by CIP and DARS in collaboration with Agora, a fertilizer company which recommended a special fertilizer blend for SP. The trial has been planted to assess the response of OFSP varieties to customised fertilizer blend for maximum root yield. Five OFSP varieties ('Anaakwanire', 'Chipika', 'Kadyaubwerere', 'Kaphulira', and 'Mathuthu') have been planted on the trial. The fertilizer blend is 10:20:20+6S and was applied as basal dressing at planting, and 25:00:27 was applied as top dressing during vegetative stage to all varieties (Fig. 42) at different levels. Soil sampling was collected before planting to assess nutritional status.

Figure 42. Top dressing of fertilizer being applied.

Cassava. The project seeks to conduct a 'fertilizer' experiment in the 2017–18 season to investigate the yield response of RTC varieties under different fertilizer combinations. This fertilizer trial is established at three sites (Chitedze, Chitala, and Makoka) which were established successfully in anticipation of fertilizer application at 1 month after planting. The nature and design of a fertilizer trial necessitate the use of straight fertilizers which are not commonly found in Malawi. The experimental design for the study was a randomized complete block design with three replications. One cassava variety, 'Sagonja', was used for the evaluation of 30 fertilizer combinations, including the control. Each plot has four ridges spaced at 0.9 m and 9 m long. At the time of the planting season, the project had not been able to source the straight fertilizers locally. The planting was still done in anticipation of sourcing the fertilizers regionally. However, there is a scarcity of *muriate* of potash suppliers in the region, so the identification of a supplier took longer than expected. The time required to import also meant that the fertilizers would reach the custody of project staff too late in the season to form any meaningful treatment in the trial. As a result, we was agreed to push this activity to the next growing season. Nevertheless, it was agreed that the established fields be maintained as a source of seed for the following year. During the NCE period, weeding was done in all trial sites.

Output 1.3.3: Environmentally sustainable pest and disease management practices developed, demonstrated, and scaled up

Cassava. Termites are a well-known pest of cassava and, with the climate change that has caused an increased frequency of prolonged dry spells/droughts, the problem is being exacerbated. The project successfully set up the research trial on the evaluation of neem (*Azadirachta indica* A. Juss) extracts and chemical pesticides for the management of termites in cassava. The main objective of this trial is to:

- Evaluate the performance of neem extracts and gaucho for the control of termites in cassava
- Investigate the performance of neem extracts for the control of termites based on plant parts used (leaf, kernel, and bark)

These trials were set in two locations, Chitedze and Chitala Research Stations, where data are currently being collected. By the end of this reporting period, the trials will be at 3 months after planting out of an average 12-month season. As a result, data and conclusions from these trials will only be reviewed and reported in Q3 of 2018–19. Table 31 summarise the cassava activities under Output 1.3.3 . Figures 43 and 44 show neem leaves being processed for control of termites in cassava.

Table 31. Progress of activities under Output 1.3.3

Activity	Activity Indicator	Y2				Reasons for Deviation
		Milestones	Target	Actual	% Achieved	
Evaluate and quantify yield loss caused by major pest and diseases of RTCs	No. of research trials conducted	1 research trial conducted (Y2–Y5)	1	1	100%	Planted but postponed due to scarcity of straight fertilizers.
Evaluate locally available affordable eco-friendly options for control of major RTC pests/diseases	No. of research trials conducted	1 research trial conducted for cassava in Y2 (termite trial)	1	2	200%	1 trial on cassava termite control planted in 2 sites. Another trial on mapping CBSD source of resistance established in 2 locations.

*Figure 43. Technicians collect and prepare neem leaves and bark extracts for the evaluation of neem (*Azadirachta indica A. Juss*) extracts and chemical pesticides for the management of termites in a cassava trial.*

*Figure 44. Technicians collect neem leaves for the evaluation of neem (*Azadirachta indica A. Juss*) extracts and chemical pesticides for the management of termites in a cassava trial.*

Output 1.3.4 Infrastructure improvement in support of Objective 1 (phased implementation depending on budget development

In 2017–18 CIP supported the purchase of a water distiller for the TC lab at Bvumbwe Research Station (Fig. 45, Table 32). The equipment that was in the lab is too old for further maintenance. This equipment is important as the technicians have been buying distilled water from Malawi Bureau of Standards.

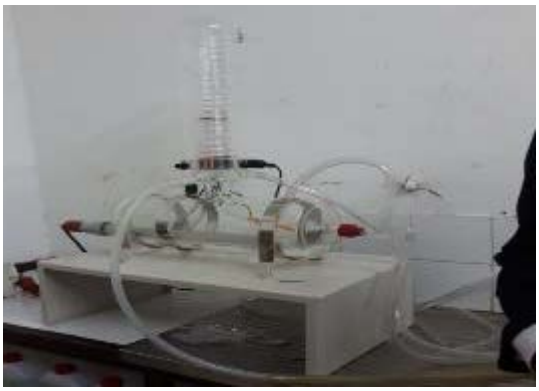

Figure 45. Water distiller for Bvumbwe TC lab.

Table 32. Summary of Output 1.3.4 (phased implementation depending on budget development)

Activity	Activity Indicator	Milestones	Target	Actual	% Achieved	Reasons for Deviation
Procure required lacking equipment and supplies for TC lab	Key essential lacking equipment and supplies procured/ repaired and used for TC	Essential needed equipment are procured	1	1	100%	Procurement of water distiller, pH meter; fluorescence lights and auto clave

2.2 Objective 2: To Increase Profitability, Consumer Orientation, and Nutrition Outcomes Of RTC VCs

2.2.1 Outcome 2.1: Diversified and expanded utilisation of potato, SP, and cassava for food security and improved nutrition (at least 80,000 women and 60,000 under-5s)

RTC-ACTION is working with producers, traders, processors, and nutrition programmes to increase the profitability, consumer orientation, and nutrition of RTC VCs. In terms of nutrition outcomes, at least 80,000 women and 60,000 under-5s in project areas will incorporate and utilise diverse forms of potato, SP, and/or cassava leaves in their daily diets, resulting in improved diet diversity and diet quality. The project will target HH with children under 5 and pregnant/lactating women with nutrition education and demos. HH-level food processing, preparation, preservation, and utilisation will be part of this intervention. This will result in 65% of vulnerable HH regularly practicing improved RTC food preparation and consumption as part of improved infant and young child-feeding as well as improved overall HH nutrition. Further, the project is working to increase crop

revenues for RTCs by smallholder producers through sales to profitable markets. In relation to commercialisation of RTCs, the project is working to reduce post-harvest losses while extending availability on the market or shelf-life. Outputs of objective 2 follows.

Output 2.1.1 Potato, SP, and cassava effectively integrated into local diets, with an emphasis on vulnerable HH

Improving nutrition through RTCs is a central objective in Malawi and building in particular on successful OFSP nutrition previous interventions. RTC-ACTION is undertaking a two-pronged approach to achieving changes in nutrition behaviour to increase consumption of nutritious RTCs, specifically among young children and women of reproductive age. This approach combines (1) increasing awareness and knowledge of nutrition and micronutrients in particular and (2) support for improved RTC utilisation as a baby food. The project is working with existing structures by government and other partners on national initiatives, especially the 1,000 important days Scaling Up Nutrition project. Interventions include information, education, and communication materials on nutrition, sanitation, and hygiene use and integrate them into the Malawi standard nutrition education initiatives. Table 33 summaries Output 2.1.1 (there were no deviations).

Table 33. Summary of Output 2.1.1

Activity	Activity Indicator	Milestones	Target	Actual	% Achieved
Consolidate knowledge base on local diets and current use of RTCs across seasons; and identify scope for diversifying and expanding RTC utilisation.	No. of calendar-based listings of locally available foods developed	HH consumption survey done in the districts by Y2	1	1	100%
Update competencies and skills of community-based practitioners	No. of practitioners and extension personnel trained in RTC nutrition	30 nutrition/ extension staff trained annually (Y2–Y5)	30	50	166%
Implement HH and community nutrition education and food preparation demos through local health centres, schools, and community nutrition programmes	No. of RTC cooking and nutrition-oriented demos held	30 cooking demos held annually (Y2–Y5)	5	5	100%

Implement HH and community nutrition education and food preparation demos through local health centres, schools, and community nutrition programmes

Household consumption survey. The survey was organised to assess production, processing, and consumption of OFSP at HH level in the rural communities. The study was conducted in the districts of Southern Region of Malawi in March 2018. Four districts (Nsanje, Mulanje, Chiradzulu, and Mangochi) were sampled for the study. Findings of the survey will help CIP to improve its planning and implementation for the remaining period of the project. During the NCE data were entered and analysed; a draft report is available for peer review.

Refresher nutrition training for district nutrition teams. The training which was held at Annies Lodge in Zomba involved some of the District Nutrition Coordination Committee (DNCC) members which include the food and nutrition officers from the Ministry of Agriculture, nutrition officers from the Ministry of Health, community development officers, schools health and nutrition coordinators from the Ministry of Education, and senior nutrition and HIV officers from the Department of Nutrition, HIV and AIDS (DNHA) at the councils (Table 34). This involved six districts and will be scaled down to the remaining districts. The aim of the training was to give the participants the knowledge and skills to prepare and give trainings on different OFSP nutritional

messages and use of OFSP in multi-mix dishes, exclusive breast feeding and complementary feeding, as well as developing new activities to promote OFSP use.

Table 34. Participants at the refresher course

District	Participation		
	Male	Female	Total
Zomba	5	1	**6**
Chiradzulu	3	2	**5**
Blantyre	1	3	**4**
Thyolo	5	0	**5**
Mulanje	4	1	**5**
Chikwawa	3	2	**5**
Total	**21**	**9**	**30**

Step-down trainings for community service providers for nutrition counselling and food demos. The district teams who are also members of the DNCC developed work plans at the refresher course in Zomba on step-down activities. The DNCC members facilitated the trainings (Figs. 46 and 47) in the six districts that were attended by the front-line extension workers. These include the AEDOs from the EPAs in the districts, disease control and surveillance assistants (formally known as health surveillance assistants) from the health centres within the implementing EPAs, and CDAs. The main goal of the interactive step-down training is to give the participants the knowledge on different OFSP nutritional messages and use of OFSP in multi-mix dishes, exclusive breastfeeding and complementary feeding, as well as hygiene practices that are required in breastfeeding, complementary feeding, and food preparation. Training was done to 68 AEDOs, health surveillance assistants, and CDAs (Table 35).

Table 35. Participants of step-down trainings on nutrition

District	Participants		
	Male	Female	Total
Zomba	14	5	**19**
Mulanje	7	10	**17**
Blantyre	7	7	**14**
Chiradzulu	5	4	**9**
Thyolo	1	8	**9**
Total	**34**	**34**	**68**

Figure 46. Some of the care-group cluster leaders after the step-down training in Zomba on March 15th 2018.

Figure 47. Temwanani Mnjengezulu, a food and nutrition officer, makes a point during the Community Service Providers Training at Mulanje Mission Youth Centre Hall.

Nutrition training of care groups and counselling session on infant and young child-feeding practices. This was done concurrently with the training of the extension workers and directly targeted the care-group cluster leaders in order to counsel them on OFSP nutrition behaviour change; dietary diversity; vitamin A and its core functions and sources as well as vitamin A deficiency effects; and exclusive breastfeeding, complementary feeding, sanitation, and hygiene (personal, food, and environment).

The main focus was on OFSP nutrition because the other issues were just a review of what the cluster leaders already learnt during the implementation of a project on Support for Nutrition Implementation by various partners. The training involved 45 care-groups with 245 cluster leaders (10 males, 235 females). The training will continue with the remaining care-groups. Each cluster leader scaled down the activities to the HH they look after (8–12 on average).

Cooking demos. These were done during the step-down nutrition trainings for community service providers (extension workers as well as cluster leaders). Much emphasis was on the recipes developed from OFSP. The aim of the recipe demo was to equip the participants with skills and knowledge on food preparation so that they will be able to select appropriate local ingredients to prepare child-friendly and nutritious OFSP meals as well as develop complementary multi-mix recipes which use at least three food groups. The demos were done using the community-led approach whereby the participants were encouraged to bring their own food materials for the cooking demos. This is what is encouraged so that the communities will be empowered to use resources available. The **245 (10 males, 235 female)** cluster leaders and **68 (34 males, 34 females)** extension workers participated.

Cooking demo at health centres. The RTC-ACTION project conducted food-cooking demos at health centres from June 20th to 22nd, 2017, in Thyolo district. OFSP porridge, 'mandazi', juice, one-pot dish with beans and one-pot dish with usipa/soya pieces were prepared (Fig. 48). A total of 325 lead parents and 46 health surveillance staff participated (Table 36).

Table 36. Participants in the cooking demos at health centres in Thyolo

Participants	Date (2017)	EPA	Section	Health Centre	M	F	Total
Lead parents	June 20th	Matapwata	Mikolongwe	Mikolongwe	3	94	**97**
	June 21st	Dwale	Dwale	Bvumbwe	7	86	**93**
	June 22nd	Masambanjati	Molere	Molere	11	124	**135**
	Total				**21**	**304**	**325**
Health workers	June 20th	Matapwata	Mikolongwe	Mikolongwe	3	6	**9**
	June 21st	Dwale	Dwale	Bvumbwe	8	15	**23**
	June 22nd	Masambanjati	Molere	Molere	4	10	**14**
	Total				**15**	**31**	**46**

*Figure 48. Cooking during field day at Mombezi EPA, Chiradzulu district (*left*) and products (OFSP products).*

Male cluster leaders (lead fathers) participated in the cooking as an innovative way of transferring nutrition knowledge to HH (Fig. 49).

Figure 49. Lead father explains how flitters are made from OFSP during the food displays at Nchima in Thyolo on March 23rd, 2018.

Nutrition information, education, and communication materials. Materials on awareness of vitamin A and its core functions, the importance of OFSP varieties, and the improved child-feeding practices were distributed. This will help to disseminate the OFSP nutrition message to the target beneficiaries in the implementing districts to enhance nutrition behaviour change.

Further cooking demos were done during the harvest field days, one site per EPA. They involved community members and care-groups who benefitted from the OFSP vine distribution under the rain-fed production. A total of 17 cooking/field days were conducted, where 1,099 (318 males, 781 females) community members and 136 (58 males, 78 females) extension workers participated (Table 33). In complying with relevant nutrition training guidelines, counselling cards (Figure 50) were used and males (Figure 51 were involved).

Table 37. Cooking demo sites during the NCE period

District	EPA	M	F	Total	District Totals
Mulanje	Thuchira	23	49	**72**	**173**
	MJ Boma	16	40	**56**	
	Msikawanjala	10	35	**45**	
Neno	Neno	62	102	**164**	**164**
Mwanza	Mwanza	16	50	**66**	**148**
	Thambani	29	53	**82**	
Phalombe	Nkhulambe	30	45	**75**	**152**
	Naminjiwa	22	55	**77**	
Zomba	Mpokwa	15	86	**101**	**199**
	Likangala	11	26	**37**	
	Chingale	28	33	**61**	
Chiradzulu	Mombezi	28	57	**85**	**120**
	Thumbwe	31	4	**35**	
Thyolo	Masambanjati	7	82	**89**	**159**
	TO Centre	9	61	**70**	
Blantyre	Chipande	23	37	**60**	**120**
	Ntonda	16	44	**60**	
Total		**376**	**859**	**1,235**	**1,235**

Conduct quarterly monitoring and supportive supervision of nutrition activities at district and community levels

Brief meeting with the DNCC. The main goal of the meeting was to brief the DNCC on the activities that the RTC-ACTION project's nutrition component is implementing in the districts

mainly using the community-led approach through the use of existing care-group structures to share knowledge and skills on different OFSP nutritional messages and use of OFSP in multi-mix dishes, exclusive breastfeeding and complementary feeding, as well as developing new activities to promote OFSP use.

The DNCC comprises of key government sectors, civil society organisations, and private sector agencies implementing food and nutrition activities and producing food products in a district. The DNCC is responsible for coordinating nutrition programmes and interventions within the district. The DNCC is coordinated through the local government in collaboration with DNHA. The district nutrition priorities are in line with the national vision and goals. Reporting is directed to DNHA with copies to local government. The DNHA will continue to advocate for strengthening of DNCC, district- and community-level structures through filling of posts, training, mentoring, and supervision. Within the local governance structure, the DNCC is a technical committee of the DEC chaired by the director of planning and development on behalf of the district commissioner. A total of 125 (78 males, and 47 females) participants from various stakeholders in the district attended the meetings.

During the NCE, DNCC was done in Nsanje, where 25 (12 males, 13 females) attended by various stakeholders in the district.

DNCC joint field visit. The aim was to brief the DNCC members in Chiradzulu, Blantyre, Zomba, and Thyolo on the activities implemented, as well as the DNCC members visiting the target beneficiary HH to appreciate the nutrition activities implemented by the various stakeholders.

The main focus was on the nutrition education sessions using the counselling cards, the care-group cluster HH's knowledge and utilisation of what they have been learning, the availability of sanitary structures in the HH, integrated HH farming, as well as the food that was prepared from various food stuffs for dietary diversification.

During the visit we note that the care groups are also encouraged to grow OFSP for vitamin A. Therefore, it was in this context that all the clusters were given SP vines for their communal field for further multiplication, and distribute the vines to the beneficiary HH.

Collaboration with Malawi Red Cross Society. To intensify OFSP nutritional promotion, CIP, through the RTC-ACTION project, is collaborating with the Malawi Red Cross Society for the integration of OFSP into HH diets in Mulanje and Neno districts, effective June 1st, 2018. The objective of the collaboration agreement is to establish the basis for a technical and scientific collaboration between CIP and Malawi Red Cross Society under the project.

Malawi Red Cross Society is implementing a project titled Scaling Up Nutrition in TA Mabuka in Mulanje district and TAs Chekucheku and Dambe in Neno district. They identified OFSP as a-cost effective tool to reduce vitamin A deficiency and provide essential nutrients for pregnant women, lactating mothers, and children under 2 years. The project is being implemented using the care-group Model in 14 GVHs in TA Mabuka, Mulanje and 8 GVHs in TAs Chekucheku and Dambe, Neno. A total of 104 (48 in Mulanje and 56 in Neno) care groups will be targeted.

2.2.2 Outcome 2.2: Improved and diversified commercial processing and marketing of RTC foods (at least 7,000 farmers selling profitably to commercial processors)

The project seeks to contribute to the development of sustainable markets for RTCs at the smallholder farmer level. This will be done by drawing from existing capacity for processing products by small enterprises in most districts by providing linkages between reorganised and restructured farmer groups and processors. Subsequently, we expect that the project will develop and implement a sustainable model for RTC VC development.

Output 2.2.1: RTC products developed and promoted

Tehila Bakery developed three OFSP-based commercial products: buns/dinner rolls, bread, and doughnuts. Tasting trials have been conducted during district extension staff trainings using a hedonic scale (5 = excellent, 4 = very good, 3 = good, 2 = average, 1 = unacceptable). Attributes tasted include shape, colour, taste, texture and flavour on a sensory evaluation form (Fig. 50). The forms with feedback were collected for analysis to be done soon.

Figure 50. Sensory evaluation of OFSP products during extension staff training at Kukhala Motel, Nchalo for Nsanje and Chikwawa district staff.

Further, OFSP is taking advantage of the existing mandazi and doughnut industry which is dominated by small-scale enterprises; overall, though, it is a large industry. A gross margin has been developed for the doughnuts based on eight women in Nsanje. The results revealed that if 40% of OFSP puree is used to make doughnuts or mandazi, for everyone Malawi Kwacha (MK1) invested into the business, there is a profit of MK 3.60 (all things being equal). The study was conducted in Nsanje district, which is one of the main OFSP-producing areas in Malawi. The study targeted a women's group based at the main trading centre of Nsanje Boma and who were trained by CIP in 2017 on how to make different products using OFSP. Appendix 3 provides more details of the gross margin analysis for doughnuts. A marketing flyer (Fig. 51) for the doughnut sellers was developed depicting use of home-grown produce for the industry 'zolima tokha'. Other activities under Output 2.2.1 are summarised in Table 38.

Table 38. Summary of Output 2.2.1 activities

Activity	Activity Indicator	Milestones	Target	Actual	Achieved	Reasons for Deviation
Develop nutritious RTC-based products using specific variety characteristics	No. of product testing trials conducted per crop	2 for SP	2	3	150%	OFSP/buns, bread and doughnuts
Promote the production and marketing of consumer-preferred RTC-based products	No. of media outlets advertising RTC products; no. of community-based theatre sessions; no. of flyers for RTC based products	2 media campaigns conducted upon product release	1	1	100%	During a regional meeting

Figure 51. Marketing flyers for doughnuts and mandazi sellers.

Output 2.2.2: RTC producer organisations strengthened for production and marketing

This project activity aims at providing producer groups with basic skills to engage in commercial production practices for supply to agro-processing industries. The activity involves development of gross margins to inspire and guide producers, identifying markets, organising farmers, and linking them to markets. Following are activities for this output.

A process to update gross margins was conducted, where 34 AEDOs, 35 potato, and 68 OFSP farmers were trained on filling of forms for gross margin data collection during the reporting period. The activity has been ongoing throughout the production season in some districts and will continue in the remaining districts, especially during the winter. Data are being collected as harvesting has just commenced in the districts. The information gathered will be used to help producers estimate cost of production and, more importantly, help them negotiate for better prices of their produce. These efforts will help the project to assess the contribution of the project in improving producers' income.

Another important activity supporting the promotion of beneficiary linkage to market was organising producers in formal groups and associations. During the year, the project managed to support the creation and revamping of the following producer groups: in Dedza five new potato producers (115 members) have been established with the aim of mobilising their produce together and link them to organised markets. In March one group (Mwaiwathu potato group) was successfully linked to United Purpose to supply 2 MT of 'Mwai' at an agreed price of MK 250/kg during harvest. This will yield a revenue of MK 500,000.

During the NCE, 18 clubs from Dedza with 119 (59 females, 60 males) members have expressed interest to register as a potato cooperative after receiving training in group dynamics. A steering committee that is leading the process with support from the project was also elected.

CIP supported 410 potato farmers from Ntcheu and Dedza who were linked to Golden Peacock and Lilongwe Hotels in Lilongwe. Negotiations are at an advanced stage pending delivery of samples. The agreement will be finalised once a contract has been signed and the two parties agree to the terms and conditions of their contract. High-visibility 'model' fresh markets supported for improved marketing of RTC produce: 230 potato producers from Nankungwi Cooperative were linked to Chipiku stores in Lilongwe. A total of 59 MT of table potato was sold and revenue of $9,833 was realised by the producers. The cooperative did not manage to reach the agreed volume because of the prolonged drought that affected potato yield and quality. Following

further agreement, the company has promised to buy more potatoes from the producers as one way of supporting the group and also because of quality of tubers produced despite being less than the anticipated volume. The group is negotiating with the supermarket to supply table potatoes during summer harvest. Umodzi Sweetpotato Association from Nsanje was linked to Universal Industries, where they sold 6.4 MT of roots and realised a total revenue of $1,343.

Sweetpotato. In Zomba, two OFSP producer clubs (68 members) have been established to promote market linkages for vines and roots. In general, vine producers were assisted to get markets in the season (Tables 39 and 40). CIP supported the vine multipliers with pre-basic seed, training, communication materials, labels, and registration with the SSU, and facilitated inspections. Hence the buying price for CIP is MK 500/ bundle. However, CIP negotiated for a minimum of MK 750/bundle for other buyers/NGOs, although farmers may negotiate more than this. In total, farmers generated MK 59,459,000 (about $81,907) during the reporting period.

Table 39. Value of incomes for farmers generated from vine sales facilitated by RTC-ACTION project

District	EPA	Name	Winter Dissemination (2016–17)	Summer Dissemination (2017–18)	NCE Period Dissemination (2018)	Total No. of Bundles	Total Value (@K500/bundle)
Blantyre	Lunzu	M. Chapweteka	668	571		1,239	619,500
Blantyre	Soche	G. Gomani	2,981	780	1,500	5,261	2,630,500
Blantyre	Soche	Kings Gadama	1,236	805	1,142	3,183	1,591,500
Blantyre	Ntonda	Stark Bophani	0	1,538	742	2,280	1,140,000
Blantyre	Ntonda	Bridget Chiziko	0	1,091	1,513	2,604	1,302,000
Chiradzulu	Mombezi	H. Ngwalo	270	0		270	135,000
Thyolo	Dwale	D Mankhwanda	0	1,526	2,033	3,559	1,779,500
Thyolo	Dwale	Anne Mazulu	307	0		307	153,500
Thyolo	Dwale	John Kositema	0	704		704	352,000
Thyolo	Dwale	Eliza George	0	1,199		1,199	599,500
Thyolo	Dwale	Mc White	0	243		243	121,500
Thyolo	Dwale	Miswell Chitete	0	18		18	9,000
Mulanje	Msikawanjala	Mbebuwa	4,000	4,602	1,639	1,0241	5,120,500
Nsanje	Zunde	Hussen Hamuza	250	0		250	125,000
Nsanje	Nyachilenda and Zunde	Umodzi Association	1,350	2,992	4,792	9,134	4,567,000
Chikwawa	Mitole	Notcha Andrew	0	300		300	150,000
	Mitole	Leonard John	0	415		415	207,500
	Livunzu	Thom Thapanya	0	1,102		1,102	551,000
	Livunzu	Thenford Alumando	0	686		686	343,000
Neno	Neno	Ubale club	0	336		336	168,000
Zomba	Chingale	Talandilidwa club	0	1,000	500	1,500	750,000
Zomba	Thondwe	Maxwell Nkhoma	113	1,132	1,293	2,538	1,269,000
Zomba	Thondwe	Mwachande Lamya	0	78		78	39,000
Neno	Neno	Jonasi Goliath	0	164		164	82,000
Thyolo	Dwale	DARS	0	217		217	108,500
Thyolo	Dwale	Rose Kumwenda	0	6		6	3,000
Total			**11,175**	**21,505**	**15,154**	**47,834**	**23,917,000**

Table 40. Facilitated by other buyers (summer 2017/18)

District	EPA	DVM	Buying Organisation	No. of Bundles Sold		Unit Price (K)	Total Revenue (K)
				Summer 2017/18	NCE 2018		
Blantyre	Lunzu	M. Chapweteka	Agora	191		750	143,250
Blantyre	Soche	G. Gomani	Agora	750		750	562,500
			YAED	150		500	75,000
Blantyre	Ntonda	S Bophani	UP Thyolo	62		750	46,500
Chiradzulu	Mombezi	H. Ngwalo	Ripple Africa Conservation	1,204		750	903,000
Thyolo	Dwale	D Mankhwanda	ADRA Malawi	3,500		750	2,625,000
Thyolo	Dwale	J Kositema	ADRA Malawi	1,200		750	900,000
			Concern International	3,600		750	2,700,000
Mulanje	Msikawanjala	D Mbebuwa	Fellow DVMs	825		500	412,500
Mulanje	Mulanje Boma	N Konala	CIP MISST, Ripple Africa, Agora & UP	14,349		750	10,761,750
Mulanje	Mulanje Boma	N Konala	FAO		20,000	800	16,000,000
Total				**25,831**	**20,000**		**35,129,500**

Year 2 Summary	Quantities	Total		
Total bundles sold to CIP	47,834	23,917,000		
Total bundles sold to other buyers	45,831	35,129,500		
Total bundles sold to fellow DVMs	825	412,500		
Total revenue for all bundles sold	94,490	59,459,000		

Note: Unit price for CIP = MK500/bundle
Total area of seed production (ha) 5ha and 7ha for Nankhwali farm (Ned Konala); Total area for root production covered by bundles disseminated = 255.12ha

Number of vine multipliers= 27

Year 1	Sold to CIP	30,796	500	K15,398,000
Total area of seed production (ha)= 12.318				
Total area for root production that can be covered by 30796 bundles produced = 83 ha				
Number of vine multipliers= 29				
Plant population per ha for root production = 37,037plants/ha				

Cassava

There was support for reorganisation and restructuring of cassava farmer groups/cooperatives and marketing so that they can be engaged. Within this reporting period, the main aim of this activity was to identify farmer groups which would be the primary targets of all structural reorganisation activities in the preceding years. The target for Y2 was to identify seven potential farmer groups or cooperatives. The identification was successfully done by IITA in collaboration with the Cassava: Adding Value for Africa (C:AVA) project being led by Chancellor College in Zomba, which has good expertise in cassava farmer group mobilisation for commercialisation. On this activity project staff held discussions with different farmer groups in Mangochi, Lilongwe East, Kasungu, Mzimba South, Mzimba North, and Nkhatabay (Fig. 52).

Figure 52. A farmer group holds a discussion with cassava project staff in Mangochi.

A needs assessment and a situation analysis for each and every group were done using tools developed by IITA and C:AVA to evaluate how these groups can be assisted to improve production and commercialisation efficiency at different levels of the VC. Six farmer groups were identified and earmarked for further engagement, signalling 86% achievement rate (Table 41). The project team was not able to identify an already existing cassava farmer group in Mzimba South. However, an agreement with the AEDC for the area was made to identify a potential farmer group that is engaged in any other RTCs or grain crops but interested in venturing into cassava production.

Table 41. Results of the farmer group identification exercise

District	EPA	Group/Group Leader	No. of Members	Female Members
Mangochi	Nansenga	Mwambo Club	18	15
Lilongwe East	Mkwinda	Mkangamira	40	12
Lilongwe West	Mngwangwa	Tithetse Umphawi	50	30
Kasungu	Chipala	Kamwala	53	38
Mzimba North	Emsizini	Lusangadzi Dairy Cooperative	Not yet defined	Not yet defined
Nkhata Bay	Chintheche	Isaac Mkhuta Banda	Not yet defined	Not yet defined

Identify seven potential cassava farmer groups/cooperatives to be supported in Y2.

Following the reorganisation of the activity of cassava farmer groups that was done in March, a needs assessment and a follow-up trip were successfully done in June 2018. The needs assessment and situation analysis were done to establish areas of project intervention in the cassava VC. Basically, the assessment was categorised into two: (1) the availability of cassava-planting materials and (2) capacity building. For the latter, the assessment was also culled to three major areas: cassava production, business management, and group management (Table 42, Fig. 53).

The needs for training on improved cassava husbandry practices was identified in all the seven farmer groups which were visited. Additionally, varietal selection and pest and disease control came out as pressing needs from the farmers. There was also a demand for formal training in seed certification and quality control.

Table 42. Results of the needs assessment exercise for cassava cooperatives.

Group Name	District	Needs Assessment
Mwambo Club	Mangochi	-Access to planting materials -Market linkage -Training on cassava production -Training on business management -Training on cassava value addition processes
Mkangamira Cluster	Lilongwe East	-Access to cassava improved varieties -Hosting of demonstration plot -Training on cassava production -Training on cassava seed certification processes -Training on cassava value addition processes -Training on gross margins calculation and marketing -Training on group dynamics and financial management
Tithetseumphawi Cooperative	Lilongwe West	-Access to both bitter and sweet cassava improved varieties -Exchange visits -Training on cassava production -Training on cassava value addition processes -Training on gross margins calculation -Training on group dynamics, group formation, and conflict resolution
Kamwala Farmer Group	Kasungu	-Market linkage -Access to cassava improved varieties -Hosting demonstration plot -Training on cassava production -Training on gross margins calculation, record keeping, and marketing -Training on group dynamics, group formation, conflict resolution, and financial management
Manyamula Farmer Group	Mzimba South	-Access to improved cassava varieties -Market linkage -Exchange visits -Training on cassava production -Training on cassava seed multiplication certification process -Training on gross margins calculation -Training on cassava value addition processes -Training on group dynamics, group formation, & record keeping
Lusangadzi Farmer Club	Mzimba North	-Access to improved cassava varieties -Market linkage -Hosting of demonstration plot -Training on cassava good agricultural practices -Training on cassava seed multiplication certification processes -Training on gross margins calculation, record keeping -Training on group dynamics and financial management
Chintheche Farmer Club	Nkhatabay	-Access to improved cassava varieties -Market linkage -Hosting of demonstration plot -Training on cassava good agricultural practices -Training on leadership and financial management

*Figure 53. Farmer groups attending the needs assessment exercise in Nkhata bay (*left*) and Kasungu (*right*).*

Develop an appropriate evidence-based model for sustainable VC development. *One model developed and operationalized by Y4.* IITA is conducting a study to establish the production costs of cassava root and cassava seed production to be able to calculate the gross margins. The rationale behind this exercise is to generate parameters to feed into comprehensive, different productivity models currently under development. IITA is therefore tracking the production practices and productivity of four farmers in each of the seven districts of the RTC-ACTION project (two project beneficiaries and two non-beneficiaries). IITA purchased 28 scales for distribution to farmers for tracking cassava yield during piece-meal harvests.

Strengthen small and medium-sized enterprises (SMEs) processing cassava (identify potential four SMEs/processing groups to be strengthened)

Sustainability of all the outreach work that the RTC-ACTION project is doing depends on the availability of a sustainable cassava market within the main roots-producing areas of the project to uptake and add value to what the farmers are producing and sell it up the VC. To achieve this, the project seeks to strengthen SMEs that are involved in cassava processing to increase their capacity and motivation to absorb the cassava root supply in their localities. In this regard, the project's target was to identify four potential SMEs or processing groups within Y2 so that they can benefit from the project's strengthening of SME activities in Y3 and onwards. In five districts we identified five processors who are producing cassava starch for industrial use and who are willing to work with the cassava farmers group and provide them a better cassava market (Fig. 54 and Tables 43 and 44). Most of the processors are still not yet fully established and operate seasonally; hence they clearly need the project's intervention.

Figure 54. A processing facility for Sir Harkson processors in Mzimba.

Table 43. Cassava-processing enterprises identified in March 2018 for strengthening activities

District	Processor	Product
Machinga	Robert Ngumbira	Cassava starch for industrial use
Lilongwe East	Ziwawo Starch factory	Cassava starch for industrial use
Lilongwe West	Masimbe Starch Fatory	Cassava starch for industrial use
Mzimba North	Sir Harkson Processors	Cassava starch for industrial use
Nkhatabay	Nkhuta Banda	Cassava starch for industrial use

Table 44. Progress of activities under Output 2.2.2

Activity	Activity Indicator	Milestones	Target	Actual	Achieved	Reasons for Deviation
Provide producer groups with basic skills to engage in commercial production practices with agro-processing industries	No. of producer groups trained in business skills/ savings and loan	5 producer groups trained for SP	5	5	100%	2 groups from Zomba, 2 from Mulanje, and 2 from Nsanje, where 1 is a women's group in business of OFSP mandazi and are interested in producing their own roots.
		5 producer groups trained for Potato	6	7	117%	2 potato producer groups in Mzimba who want to register as an association. 2 groups from Ntcheu, 2 from Dedza, and 1 from Lilongwe West were all trained on business skills.
Implement consumer education and improved product labelling to promote informed and health dietary choices	# of media campaigns conducted	2 community awareness campaigns held for each crop (C/SP/P) by Y2	2	1	50%	A promotion campaign in Mulanje during the launch of Madyo OFSP-based biscuits.
Support re-organisational and structural of cassava farmers' groups/ cooperatives	At least 10 farmers' groups/ cooperatives reorganised/ restructured	Identify 7 potential cassava farmers' groups/ cooperatives to be supported in Y2	7	7	100%	The activity is in progress.
	Develop and appropriate evidence-based model for sustainable VC development	1 model developed and operationalised by Y4	1	1	100%	Ongoing

Activity	Activity Indicator	Milestones	Target	Actual	Achieved	Reasons for Deviation
Strengthen SMEs processing cassava	4 pilot processing units established and equipped; at least 10 existing SMEs strengthened through capacity building.	Identify potential 4 SMEs/ processing groups to be strengthened	4	5	125%	

2.2.3 Outcome 2.3: Efficient markets linking potato, SP, and cassava producers with consumers and processors

Output 2.3.1 Gender-mainstreamed market information system established and utilised by stakeholders

A study by CIP, in collaboration with RTCDT, on the characterisation of the seasonality of RTC seed availability and demand, has just been completed pending analysis and report writing. One of the main objectives of the study is to establish the demand for the seed/planting materials for RTCs. It is expected that information collected will help to provide the much-needed feedback to various players along the RTC VC, especially regarding seed demand.

To enhance gender-mainstreamed market information, we participated in a study organised by RTCDT to assess the bottlenecks affecting the marketing of RTC products and by-products in order to come up with recommendations that could address the identified challenges with full support of producers.

Potato

Key potato marketing trainings conducted during the year. In addition to linking farmers to markets, the project also conducted a number of trainings for farmers as well as AEDOs in different districts. The trainings (Table 45) focused on a number of areas, but mainly related to markets. Specifically, the following were the areas of focus: defining a group, explaining the major theories of group development, describing methods for identifying group problems, developing appropriate strategies for their resolution, and demonstrating effective communication and gross margin analysis.

Table 45. Training marketing and group dynamics

District	EPA	Training Content	Farmers	AEDOs
Dedza	Bembeke and Linthipe	Basics of gross margin analysis & data collection		12 (2 females)
Dedza	Bembeke and Linthipe	Introduction to gross margin & data collection	38 (14 females)	
Dedza	Kanyama	Group dynamics,	48 (19 females)	4
Nsanje	Mankhanga & Nyachilenda	Basics of gross margin analysis & data collection	18 (6 females)	2
Ntcheu	Tsangano	Training producer group with basic skills to engage in commercial production practices with agro-processing industries	66 (27 females)	2 (1 female)
Ntcheu	Njolomore	Introduction to gross margin and data collection	18 (8 females)	3
Ntcheu	Tsangano	Training of producer groups in business	50 (20 females)	3 (1female)

District	EPA	Training Content	Farmers	AEDOs
		skills/savings and loan		
Mzimba	Khonsolo	Introduction to Group dynamics	85 (40 females)	4 (2 females)
Mzimba	Luweleze	Introduction to Group dynamics	56 (27 females)	3 (1 female)

Another activity that continued during the year is the tracking of potato prices in main markets of Lilongwe and Blantyre (Fig. 55). This information is provided to potato producers to guide them during negotiations for prices with potential markets.

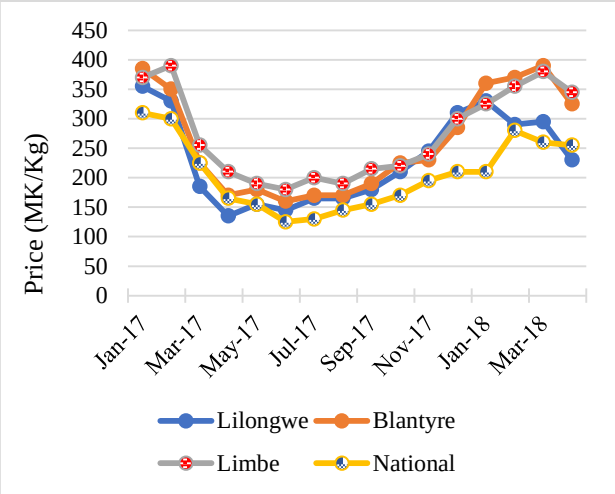

Figure 55. Trend in potato prices in the major markets in Malawi during the 2017–2018 growing season.

Output 2.3.2: Improved understanding of consumer preferences and awareness of varietal characteristics integrated along the market chain

Activity 2.3.2.1: Educate producers, traders, and vendors on consumer preferences and varietal characteristics, and improve their skill sets for effective marketing

Installation of billboard and OFSP product launch to increase awareness of OFSP products. CIP facilitated the mounting of billboard (Fig. 56) at Chinakanaka Market, a famous market for SP in the southern region. The billboard was mounted to increase awareness of OFSP products and their nutritional value to the community. During this time, the OFSP biscuits 'Madyo soft cookies' was launched by the private sector partner, UIL. OFSP products that can be used at HH level (mandazi, doughnuts, porridge, juice) were further highlighted and sampled at the market launch, demonstrating the widely available uses and integration of OFSP products into diets.

*Figure 56. OFSP billboard with nutrition message (*left*), and launch of Madyo soft cookies at Chinakanaka (*middle*) market in Mulanje district and Madyo biscuit packaged (*right*).*

Promotion and sensitisation of OFSP through National Agriculture Fair. CIP participated in the National Agriculture Trade Fair in Blantyre on August 16th–19th, 2017, under the theme 'Unleashing Full Agriculture Potential: Role of Markets'. The entire OFSP VC, from TC to finished products, were highlighted. Contact details of existing DVMs were provided to visitors interested in OFSP production for their farming enterprises. Pamphlets and flyers about CIP and its work on OFSP were shared (Fig. 57).

Other activities associated with Output 2.3.2 are shown in Table 46.

Figure 57. National Agriculture Trade Fair Exhibitions. The director for agriculture research services, CIP country director, research scientist for DARS and research associate for CIP-RTC showcasing the products and the U.S. ambassador for Malawi appreciating the work.

Table 46. Progress of activities under Output 2.3.2

Activity	Activity Indicator	Milestones	Target	Actual	Achieved	Reasons for Deviation
Educate producers, traders, and vendors on consumer preferences and varietal characteristics, and improve their skill sets for effective marketing	No. of inclusive market focus group discussions (FGDs) held	2 collective FGDs held per target district annually (Y2–Y5)	2		—	
	No. of RTC awareness and business development trainings held.	2 business trainings conducted in each target district annually	2	4	200%	4 trainings were conducted in Mzimba, Ntcheu and Dedza districts.
	No. of billboards/ public outreach materials disseminated	1 billboard constructed per target district in Y2	1	1	100%	A billboard was installed in Mulanje promoting OFSP production and consumption. A similar billboard will be built at Tsangano turn-off market with information on potato.

2.2.4 Outcome 2.4: Improved postharvest handling, storage, and transport capacities and practices

The RTC-ACTION project seeks to explore ways to reduce RTC post-harvest losses which erode the profitability of the crop for smallholder farmers due to its high perishability. The project recognises the existence of local knowledge and efforts by farmers to conserve RTCs through simple post-harvest handling techniques and elementary processing activities to increase the shelf-life of the crop. The project is also undertaking various research and means of ensuring availability of RTCs produce throughout the year.

Output 2.4.1: Simple technologies for reducing post-harvest losses identified and promoted

Sweetpotato

A trial on in-ground storability of SP roots is being conducted at research stations. The objective is to assess storability of SP roots in-ground at Bvumbwe, Makoka, and Chitala Research Stations representing different agro-ecologies. Under evaluation are five OFSP varieties: 'Anaakwanire', 'Chipika', 'Kadyaubwerere', 'Kaphulira', and 'Mathuthu'. 'Kenya', a WFSP variety susceptible to SP weevils, has been planted within a trial as the check. This trial aims at extending availability of fresh/quality roots at HH and market level. The trial is ongoing as harvesting ends at 9 months after planting.

Further, a maize and SP relay cropping OFT has been planted on farmers' fields in four EPAs of Thyolo and Mulanje districts for intensified production; 32 farmers per EPA have been reached with vines, translating to 128 farmers in four EPAs. Farmers planted SP within their maize fields at physiological maturity of maize crop to maximise the use of land. Mulanje and Thyolo are some of the few districts which receive some rains in May–July/August to the advantage of SP. OFSP varieties planted include 'Chipika', 'Kadyaubwerere', 'Kaphulira', and 'Mathuthu'.

DARS and CIP are also conducting a trial to evaluate an evaporative cooling system using a zero-energy cool chamber (ZECC) for storing SP roots. The objective of this trial is to determine the effects of cool chamber storage technique on SP's storage life and assess the acceptability of SP roots after storage. The ZECC was compared with the ordinary pit technique. The ZECC works on the principle of evaporative cooling. As water is evaporated, energy is lost from the air, reducing the temperature. Figure 58 shows the ZECC before its top is covered with grass thatch.

Figure 58. A ZECC before grass thatch.

Preliminary results indicate that the storage life of SP in the ZECC depends on the variety. In this case, 'Kadyaubwerere'—'Kadya' for short)—a deep OFSP variety, stores better in both the pit and ZECC than the other three varieties up to 4 months after storage (MAS; Fig. 59). It also had the lowest percentage of weight loss. In general, the number of rotten roots and percentage of weight loss were lower in ZECC than in the traditional pit storage. Samples from all treatments were acceptable in terms of taste assessment for all attributes during the storage period.

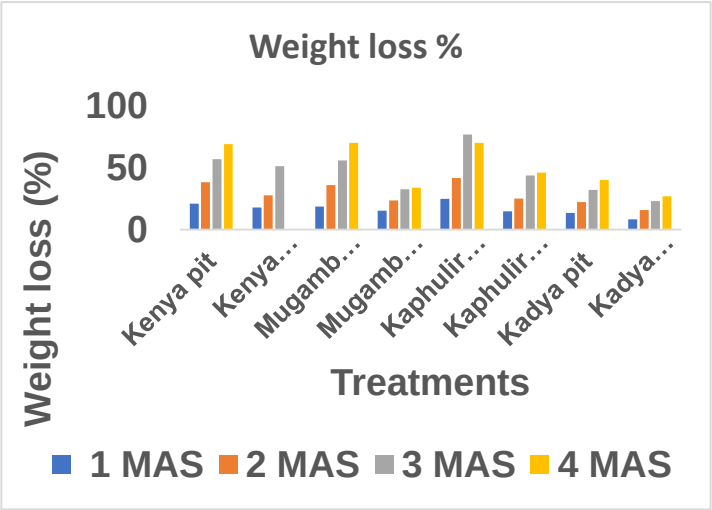

Figure 59. Weight loss (%) for different SP varieties during storage.

Cassava. The project had a target to identify three cassava storage and/or processing technologies that are in use by smallholder farmers at limited scale and have a potential for scaling up through promotion and publicity in subsequent years. To establish solid evidence for the technologies to be promoted, the project sought to conduct a survey to generate a compendium of post-harvest technologies that are popular amongst farmers. The survey was conducted on March 12th–18th, 2018, with a sample size of 367 HH in Mangochi (96 HH), Nkhatabay (85 HH), Karonga (98 HH), and Lilongwe (88 HH). Additionally, five focus group discussions were conducted (3 in Mangochi, 1 in Karonga, and 1 in Lilongwe). Data entry and analysis for the survey have been finalised and the report is being written. However, preliminary assessments by the data collectors show the prevalence of traditional processing of cassava into flour in the northern districts of Nkhata Bay and Karonga.

Table 47 summarises other activities carried out under Output 2.4.1.

Table 47. Progress of activities under Output 2.4.1

Activity	Activity Indicator	Milestone	Target	Actual	Achieved	Reasons for Deviation
Identify and promote simple technologies and process improvements in market chains to reduce post-harvest losses and safeguard quality and safety	3 technologies identified and validated by Y2	3 cassava trials	3	3		Technologies identified through survey. Data analysis for survey in progress
	SP storage methods identified	SP trials: underground storage, use of storage chambers, and relay cropping to prolong availability of roots	3	3	100%	Assessment continues

Output 2.4.2: Market access to potato, SP, and cassava expanded and increased for all consumer groups

Table 48 summarises activities on RTC produce marketing. A market was secured within Lilongwe City, where a total of 59 MT of table potato was sold for $9,833 by the producers from Ntcheu. Umodzi Sweetpotato Association from Nsanje was linked to UIL, where they sold 6.4 MT of roots for $1,343. One market on potato from Chipiku supermarket has already been identified, and the potato producer group is negotiating with the supermarket to supply table potatoes during summer harvest. UIL has also expressed interest in buying from OFSP producers who will produce good roots for making OFSP puree.

Table 48. Progress of activities under Output 2.4.2

Activity	Activity Indicator	Milestones	Target	Actual	Achieved	Reasons for Deviations
Support stakeholder meetings to design and coordinate supply chain interventions for quality RTC supply to select high-visibility markets	No. of high-visibility markets identified to benefit from interventions; no. of supply chain stakeholders identified for each end-market	2 markets identified for each crop (cassava/SP/ potato) by Y2	2	2	100%	
Facilitate negotiations and contractual agreements between	No. of supermarket and eateries identified and	3 supermarkets and/or eateries for each crop	3	2	67%	Work in progress

Activity	Activity Indicator	Milestones	Target	Actual	Achieved	Reasons for Deviations
producers and major supermarkets and gastronomic sector for promoting nutritious	interested in RTC products	identified and committed by Y2				

2.3 OBJECTIVE 3: EFFECTIVE POLICY AND STRENGTHENED CAPACITY FOR CONTINUED DEVELOPMENT OF RTC VALUE CHAINS

The project is supporting the RTCDT to effectively coordinate stakeholders for stronger policy support and more effective investments in RTC VCs. It will also strengthen human and institutional capacity to support continued innovation and development of RTCs. RTCDT activities are discussed below.

2.3.1 Outcome 3.1: RTCDT effectively coordinate stakeholders for stronger policy support and more effective development investments in RTCs

Output 3.1.1 RTCDT secretariat established and holding regular stakeholder meetings

Recruitment of RTCDT secretariat personnel. During the reporting period, the RTCDT board finalised recruitment for the RTCDT coordinator position to spearhead the operations of the Trust since expiry of former coordinators contract. The coordinator reported for duties on October 2nd 2017. As part of induction process, the newly recruited coordinator attended and participated in the cassava component stakeholders meeting, which provided a platform for interaction with over 20 stakeholders under the component. The forum also provided opportunity for the Trust to establish linkages for possible collaboration. Additionally, Mr Andrew Kumwenda replaced Mr Ahmed Msiya as accounts and administration assistant.

For the Trust to effectively deliver on its mission and mandate, the RTCDT strategic plan has been developed that is effective July 2018–June 2023. The plan recommends establishment of five key positions to its organisation structure: national coordinator, policy and stakeholder coordination officer, monitoring and resource mobilisation officer, communication, publicity, and advocacy officer, and finance and administration officer. Institutionalisation of these positions will be done gradually due to financial constraint.

Procurement of motor vehicle for RTCDT. Procurement process for an RTCDT vehicle had been finalised in March 2018, facilitated by CIP. Registration number CP 9498 is now ready for use.

Review and finalisation of RTCDT strategic plan. With support from GIZ funding, LAPE Consultants Ltd were engaged to review and finalise the RTCDT strategic plan. An overhaul of the plan development was conducted to ensure that it portrays the mandate of the Trust and guides its operations. The consultancy contract was centrally handled by GIZ and Irish Aid with funds from the RTC–ACTION project, which co-supported the process. The review and finalisation of the plan commenced in November 2017 and ended in March 2018. Three series of meetings (i.e. inception meeting, validation of the strategic plan with the board of trustees, and large stakeholder group) were done.

The total budget expenditure required for the implementation of the strategic plan amounts to $953,908, which has been itemised according to Trust's strategic pillars. Pillar I represent the highest estimated budget expenditure of $272,309 (29%), followed by Pillar III, which constitutes 16% of the estimated budget expenditure ($146,946). Pillar IV at 13% ($127,035) comes third, then Pillar II at 9% ($89,705). The launch of the plan has been planned for May 2018 as per the resolution of last board meeting.

RTCDT board of trustees meeting. Four board meeting were conducted during the reporting period. Issues which were highly articulated on the agenda of the meetings were as follows:

- Stakeholder coordination meeting through the RTCDT Annual General Meeting
- Consideration to effectively engage the private sector in the RTC VC movement
- Finalisation of the strategic plan to guide the operations of the institution
- Deliberations around the RTCDT funding mechanism and its sustainability
- Establishment of a RTCDT secretariat.

RTCDT mandate and member service satisfaction will lead to the growth of the membership base and eventually contribute to internal fund generation and therefore self-sustenance. A consultant will be engaged to develop a proposal for possible submission to potential donors as an external means of generating income. The revised strategic plan provides a framework for RTCDT operations with regard to attainment of its goals and mission when effectively implemented. But to achieve these requires adequate funding.

The Trust continues to rethink the sustainability strategies in an effort to become financially independent. Currently, the Trust is banking on the contributions collected from membership fees as an internal source of income. And although that membership base is low, it is anticipated that increased awareness of the RTCDT mandate and member service satisfaction will lead to the growth of the membership base.

Fourth board meeting. The fourth board meeting was held on June 26th 2018, at the CIP Board Room in Lilongwe; 10 trustees and ex-officials attended. The main issues discussed at the meeting were the preparations for the strategic plan launch, reviewing of the third year work plan and requirement for additional human resources for the Trust in line with the strategic plan, and the need for more awareness activities to promote the Trust to potential members. It was agreed during this meeting to have a general work plan and not only be based on the RTC–ACTION project. The work plan can be shared with other donors for support. It was also agreed that the Trust would hold more information sessions for its stakeholders, especially the farmers, to learn the government procurement processes.

RTC symposium. The RTCs symposium was held on May 22nd 2018, at Ufulu Gardens in Lilongwe under the theme: Unleashing the potential of RTC seed market and its products. The meeting drew participants from the following categories: RTCDT members, seed producers, marketers and private companies, stakeholders, and service providers. In total 47 (13 females, 34 males) attended. There were three main objectives of the symposium:

- Reflect on the supply-and-demand pool for RTC planting materials and their marketing system.
- Closely review adherence to the RTC seed regulations.
- Get an update on implementation of the Revised National Seed Policy and discuss on gaps to be bridged in implementing the policy.

At the end of the meeting, the Trust was able to consolidate the issues affecting the demand and supply of RTC seed, identify gaps for improving the adherence to the RTC seed/planting material regulation in order to improve quality, and prioritise issues for advocacy with different stakeholders.

RTCDT membership mobilization. Stakeholder meetings and planned visits to potential members who have a stake in the RTC VC were the mechanisms that have been used to mobilise

the membership of the Trust. Currently, 43 members are paid-up, and are disaggregated as follows: 29 individuals, two international organisations, three processors, and three cooperatives. However, the participation of nonregistered members in various RTC fora is high, which is yet to be tapped into the member's satisfaction of the Trusts' service delivery. RTC produce and product market access have been noted as one factor required to satisfy potential members in order to join the RTCDT movement.

Table 49 summarises activities conducted under Output 3.1.1.

Table 49. Progress of activities in Output 3.1.1

Activity	Activity Indicator (2016–2021)	Target	Achievement	Annual Achieved	Comments
Recruit account & administrative assistant	No. of persons	1	1	100%	The officer is expected to start work in January
Procure vehicle	No. of vehicle	1	1	100%	Procurement done
Review and finalise RTCDT strategic plan		1	1	100%	A consultant was identified by GIZ
Conduct stakeholder workshops, conferences, or meetings to harmonise interventions and to sensitise policymakers on the RTC sector	No. of stakeholder's meetings conducted	2	0		Planned for Y3
	No. of advocacy meetings conducted to sensitise policymakers	1	0		Planned for Y3
	No. of meetings of the RTCDT executive committee held	2	4		Include board meetings; 1 audience held with the new secretary for of agriculture

Output 3.1.2 RTCDT providing effective information services to stakeholders

The RTCDT annual general assembly. The Trust held its 2nd annual general meeting in Lilongwe under the theme 'Promotion of Root and Tuber Crops for Sustainable Food Security and Economic Growth'. It was officially opened by the Director of Research Services, Dr Wilkson Makumba, who represented the secretary for the Ministry of Agriculture, Irrigation and Water Development (Fig. 60).

Figure 60. Dr Makumba views exhibits at the RTCDT annual general assembly.

The general assembly provided actors in the RTC VCs the opportunity to talk and reflect on critical farming policy issues for markets and development, specifically on factors that affect farmers' productivity, market access, and incomes. The event gave farmers the opportunity to interact with private sector players and facilitate business-to-business linkages through interactive sessions. The meeting attracted 85 farmers who (19 of them were RTCDT registered member), 30 stakeholders, and six development partners and others. Critical issues raised from the meeting will be presented for action to relevant ministries. The issues raised will be incorporated into the advocacy agenda for the project and other relevant stakeholders in the RTCs sector.

Participation in partner and stakeholder meeting. In a bid to enforce networking, collaboration, and coordination, the Trust participated in four stakeholder meetings during the year. These meetings included (1) stakeholder meeting for the cassava component of the RTC-ACTION project, (2) planning meeting for RTC-ACTION, (3) validation workshop on climate risk management for the cassava VC and training on climate risk financing (organised by FAO, and (4) the end project completion report validation meeting, organised by the Rural Livelihoods and Enhancement Program from which the Trust also benefited as a partner. These meetings provided an opportunity for the Trust to share in the lessons learnt and build on them as it executes its duties. The cassava component stakeholders meeting provided a platform for induction for the new coordinator and interaction with over 20 stakeholders under the cassava component. During the OFSP symposium, the Trust interacted with SP stakeholders. Other activities under this output are listed in Table 50.

Table 50. Output 3.1.2 RTCIP providing effective information services to stakeholders

Activity	Activity Indicator	Target	Achievement	Annual Achieved	Comments
Establish an ICT-based information exchange for RTC planting material	No. of media-outlet channels (radio, newspaper, etc.) used	1	1	100%	Used the RTCDT website
	No. of communication materials produced and disseminated	1	1	100%	
	No. of participation in meetings with policymakers to advocate for support for RTC	1	4	400%	Participated in the stakeholders meeting for RTC-ACTION Malawi cassava component and OFSP symposium
Conduct RTCDT annual general meeting	No. of annual general meetings	1	1	100%	Conducted in December; 121 participated
Arrange interviews with TV on RTCs to be aired	No. of interviews aired	1	1	100%	Done with MBC TV during the annual general meeting
Ensure that photojournalists present at some important functions to produce pictorial focus and media pull-outs	No. of presentations	1	1	100%	Engaged *Times* and *Nations* newspaper, MBC TV to cover the annual general meeting event

Output 3.1.3 RTCDT consistently and effectively advocating RTC with policymakers

Engagement in agriculture policy processes

RTC as an emerging industry has a comparative advantage in its contribution to the food and nutritional security, income and local revenue generation, job creation, and export/import substitution in the country. It is evident that RTCs can be grown in almost all the districts in the country, have high-yielding potential per given area, are resilient to drought conditions, have low cost of production, have high economic value if processed, have potential to be grown year-round, and are very easy to manage in the field. In addition, RTCs can be used in several different forms such as cooked and eaten as a snack, processed into chips and into flour that is used in the confectionary and timber industries. Nevertheless, the enabling environment for the operationalisation of the RTC

commercialisation is underdeveloped through product and market diversification. This has prompted the need to advocate for policy issues to work in favour of RTCs.

Trusts' courtesy call with new secretary for agriculture. Three trustees (chair, vice chair, and one member), together with the RTCDT coordinator, visited the new secretary for the Ministry of Agriculture Irrigation and Water Development, Mr Gray S.V.K Nyandule Phiri, on December 5th 2017. The team briefed him about the Trust—its vision, mission, and goals. He was pleased and pledged his support towards the development of the RTC sector and the Trust.

Follow up on development of RTC products and seed standards. Five tables of standards (high-quality cassava flour, starch, cassava flour, SP flour, and SP crisps products) were formulated and submitted to Malawi Bureau of Standards (MBS), and were approved on December 22nd 2017, by its board (Table 51). They are currently being edited, and later will be published.

Table 51. Details of approved RTC product standards by MBS

Name of the Standard	Code	Status /Level of Publishing
Edible cassava flour	MS 349: 2017	Second edition Specification
Edible cassava starch	MS 350: 2017	First edition Specification
High-quality cassava flour	MS 1382: 2017	First edition Specification
SP crisps	MS 1384: 2017	First edition Specification
SP flour	MS 1385: 2017	First edition Specification

RTC seed regulations and standards. In a bid to enforce adherence and compliance in the use of improve and high-quality RTC planting material regulations, the Trust liaised with the SSU to compile the database for the suppliers of clean planting materials.

Seed certification in Malawi is governed by the Seed Act 1996, Seed Regulations 2018, and National Seed Policy 2018. The latter two documents have been reviewed, whereas the first is yet to be approved by parliament. The new versions of the documents have incorporated the interest of the RTCs, which were previously missing in the former version. Additionally, the penalties for noncompliance have been increased and approved for use.

Nevertheless, there is still some gaps to bridge to ensure effective use of the regulatory framework, as it has been observed that registration of the seed producers with the regulator still remain a challenge. One of the challenges identified in the process of seed regulation was shortage of seed inspectors. To address the situation, the department has begun to employ para-seed inspectors to aid the process. In support of this movement, the Trust through RTC-ACTION organised and facilitated training of 37 out of 110 licensed para-seed inspectors in RTCs.

Engagement of the private sector. Despite the extensive potential of the RTC sector, productivity, commercialisation, processing, and marketing remain significantly below potential. This is why the Trust would like to take drastic measures to actively involve the private sector, having recognised their roles in offering a mechanism to share the costs of infrastructure and diffusion of technology. It is also an opportunity to increase the effectiveness of technology over time. In that regard, a session to discuss public–private partnership to address policy, regulations, financing, infrastructure, and certification issues has been planned in Q1 of Y3 of the project. The Trust intends to engage relevant government ministries; NGOs such as CISANET, FUM, CIP, and IITA; and other stakeholders that are on the forefront of advancing policy and advocacy agendas regarding RTC sector development. Table 52 summarises the activities under Output 3.1.3.

Table 52. Progress of activities under Output 3.1.3

Activity	Activity Indicator	Target	Achievement	Actual	Comments
Develop and implement communication strategy for RTC policy and advocacy	No. of participants in meetings with policymakers to advocate for support for RTC	1	2	200%	Participated in the stakeholders meeting for RTC-ACTION Malawi—cassava component and OFSP symposium
Follow up the status of the RTC products standards with MBS	No. of standards	5	5	100%	% standards approved by MSB board awaiting editing and publication

2.3.2 Outcome 3.2: Human and institutional capacity strengthened to support continued innovation and development of RTCs

Output 3.2.1 Gender-integrated formal training/educational institutions meeting the human resource needs of potato, cassava, and SP

At a technical planning meeting for the RTC-ACTION project's cassava component, held on September 13th 2017, at the IITA-Malawi office, the selection of student candidates (one PhD and one MSc) for support by the project was discussed in detail. It was indicated that although the project is supporting and targeting DARS staff who are working with RTCs, the candidates should meet the requirements of IITA sponsorship. DARS reported at the annual planning meeting on January 28th 2018, that it had identified the candidates. However, progress has been slow.

Training for para-seed inspectors. Para-seed inspectors were trained in Dedza on April 16th–19th April 2018. A total of 36 inspectors were trained from 13 districts: Blantyre, Chikwawa, Chiradzulu, Dedza, Dowa, Kasungu, Lilongwe, Mangochi, Mchinji, Mzimba, Nsanje, Ntcheu, and Zomba. The topics covered included an overview of the seed regulatory framework in Malawi, seed certification procedure, and presentations on the three RTCs (potato, SP, and cassava) which were complemented by field practicals. The presentations covered issues of RTC varieties and their distinguishing traits, variety development and registration, pests and disease identification, post-harvest handling, and estimation of planting material per hectare.

Support for academic training with research on RTCs (MSc & PhD level) for selected staff or students (MSc student completes thesis research in project by end of Y5)

MSc student completes thesis research in project by end of Y5. Ms Mayamiko Ntandika, the prospective MSc student, was identified through DARS. Her credentials submitted to IITA are still being evaluated. She has been admitted by the Lilongwe University of Agriculture and Natural Resources to begin her studies in November 2018. She will be expected to conduct her research under the fertilizer trial activity of the project in the next 2 years.

PhD student completes thesis research in project by end of Y5. The prospective PhD student, Mr Kennedy Masamba, initially was admitted by a Ghana University for a 4-year PhD programme. However, owing to the period required for the study (which will fall outside the project's period), he has decided to seek admission at Chancellor College in Zomba District. His application for admission has been submitted and he is awaiting an official decision.

Mr Eliya Kapalasa, a CIP VC officer, has advanced in getting an educational placement for his PhD studies.

Table 53 summarises the activities under Output 3.2.1.

Table 53. Progress of under Output 3.2.1

Activity	Activity Indicator	Milestone	Target	Achievement	Actual	Reasons for Deviation
Support for academic training with research on RTC (MSc & PhD level) for selected staff or students	MSc student completes thesis research in project by end of Y5		1	1	100%	Ongoing activity: student identified
	PhD student completes thesis research in project by end of Y5		1	1	100%	Ongoing activity: student identified

Output 3.2.2: Support for institutional capacity strengthening of DARS, DAES, and other RTC stakeholders

To strengthen institutional capacity, the RTC-ACTION project sent the research associate for the SP component to Uganda for an internationally organised seed systems community of practice. To support continued innovation and development of RTC, CGIAR and DARS research plans and project report, CIP participated in the DARS planning and review meeting and presented the research proposals under the horticulture commodity group.

Participation in regional and international conferences

- Marketing, Processing, and Utilisation (MPU CoP), Blantyre, Malawi
  - CIP–Malawi hosted and displayed SP products at the SPHI–MPU CoP, which was conducted in Blantyre, Malawi, on April 23rd–24th at Lotus Hotel. This was the fifth annual meeting for MPU CoP, and its theme OFSP) VCs for sustainable food systems in sub-Saharan Africa. In total 75 participants from 10 countries (Ethiopia, Kenya, Uganda, Tanzania, Ghana, Nigeria, Malawi, Mozambique, South Africa, and the United States) attended (Fig. 61).

Figure 61. MPU CoP participants at Lotus Hotel in Blantyre, Malawi.

  - Panel discussion. During the MPU CoP meeting, there were a couple of panel discussion sessions. One involved the private sectors such as Euro Ingredients, UIL, and Kenya Bureau of Standards to share experiences in OFSP commercialisation. Another important panel involved SP seed multipliers and root producers. Mr Daniel Mbebuwa and Mr Gerlad Akishoni shared their challenges and opportunities in the OFSP sector.

— Field trip to Tehilah Bakery and value addition centre. During the MPU CoP in Blantyre, the participants visited Tehilah Bakery and value addition centre located in Matindi, within Blantyre district. The bakery is pioneering the production and commercialisation of OFSP bread and buns using OFSP puree. While at the bakery, nutrition care-group members from Ntonda EPA in Blantyre also participated and displayed their products that were prepared using OFSP roots. The care-group members also showcased how they carry out behaviour change activities in their communities. This was done using flip calendars that had information on personal and HH hygiene, prenatal care, and nutrition of children of different age categories and whole families.

- Seed Systems and Crop Management CoP, Kigali, Rwanda
  — Research associate for RTC-ACTION project participated at the Seed Systems and Crop Management CoP meeting. This was the ninth consultation meeting in Kigali, Rwanda, on May 15th–17th 2018, at Hotel Villa Portofino. The theme of the meeting was "Engaging youth for improved sweetpotato seed and root production". The meeting was attended by 55 participants from 12 countries: Ethiopia, Kenya, Uganda, Tanzania, Ghana, Nigeria, Malawi, Mozambique, South Africa, Burkina Faso, the United States, and Rwanda. In Malawi, Ms Chifundo Kapalamula attended to strengthen her experience on SP seed systems. During the meeting there was a poster session; Malawi presented on 'Promotion, Marketing and Dissemination of Quality OFSP Vines—A case of Malawi'.

- OFSP Processing Industry Day:
  — CIP, with support from the United States Agency for International Development, hosted an OFSP industry forum at Mount Soche Hotel in Blantyre, Malawi, on April 26th 2018. This was an open forum to the Malawians and more than 30 people from eight African countries and the U.S. working on OFSP VCs, including food processors of Malawi, participated. The objectives of the forum were to:
    - Share experiences of using OFSP in industrial processing
    - Present initial study findings of the emerging OFSP processing sector in the region
    - Provide a forum for networking and business-to-business discussion

    The processing industry and the technical experts shared their experiences on OFSP processing on new opportunities and network across countries and sectors.

- Malawi Seed Industry Development Project and the RTC-Action project activities visit:
  — A high-profile Irish Aid delegation from several African countries visited Chitedze Research Station on June 14th 2018. Showcased were the activities of the two projects, along the legumes and RTC VCs for research development, utilisation, nutrition, and marketing (Figs. 62 and 63).

Figure 63. Legumes and cereals stand displays seed for different crops; groundnuts, soybean, sorghum, millet, cowpeas, pigeon peas.

Figure 62. RTCs stand displays planting materials and roots (potato, SP, and cassava).

Bvubwe SP open day was held on June 28th 2018. This was an advance arrangement where all released and improved varieties were timely planted with the first rains in December 2017, in preparation for an SP open day at 5 MAP. All DADOS and district crops officers from the 10 districts of the OFSP component of the RTC-ACTION project were invited, as well as farmers and extension staff from Bvumbe and the media. It was demonstrated that the improved varieties yielded more than 20 ha and more if only they are planted in time. This was a targeted audience to improve SP production in the respective districts.

Project planning meetings. Several meetings were done in the year:

- A project review and planning meeting, was held at the Cross Roads Hotel on December 5th–6th 2017, to review project progress in Y2.
- A planning meeting was intended to monitor expenditure and develop work plans for (1) February–March 2018 and (2) develop a Y3 work plan and budget.

Joint field visit. A joint visit by the implementation team (CIP, IITA, DARS, and RTCDT) and Irish Aid was conducted to review project progress and visit some sites. This was conducted on April 10th–13th 2018, as a requirement in the course of project implementation. Objectives of the visit were to (1) assess the performance of finance, human resources, audit, and procurement issues and (2) visit selected project sites to see project progress, coordination, and challenges being experienced.

Financial and technical progress of the project was reviewed. On-station and on-farm activities of crop components were visited. Irish Aid participants observed that activities on technology development, especially on-station, were well implemented. The same is expected under on-farm conditions, including extra emphasis on nutritional activities. It was also indicated that a national ID cards should now be used when registering beneficiaries.

Technical backstopping by CIP Southern Region SP breeding platform. Dr Godwill Makunde, a CIP breeder based in Maputo and a key breeder in the platform, visited the Malawi breeding programme on March 27th–30th 2018. Led by Dr Maria Andrade, CIP–Mozambique lead, the Southern Africa platform aimed at coordinating SP variety development activities and provide technical backstopping. DARS and CIP breeders and technicians (Fig. 65) were fortunate to have him visiting the Malawi SP breeding programme for technical backstopping. The visit included on-station trials, OFTs, demos, and the seed system of Malawi. Obed and Felistus joined the SP breeders in Nairobi, Kenya in June 2018 where sweetpotato global scientists presented progress on sweetpotato variety development in different countries including Malawi. RTC-ACTION and the Sweetpotato Action for Security and Health in Africa (SASHA) project (funded by Bill and Melinda Gates Foundation) sponsored the meeting.

Figure 64. Dr Godwill Makunde (second from left) during the visit in Malawi, and with Felistus, the RTC-ACTION project manager.

Project visit by a CIP principal scientist. Dr Jan Low is a principal CIP scientist based in Nairobi, with vast experience in project management. She visited in April soon after the MPU CoP meeting. Her visit to the RTC-ACTION project activities was highly informative about project implementation. In honour of her role in the Malawi SP breeding programme, Dr Low was privileged to name one of the newly released varieties as 'Royal Choice' and to hand over equipment bought by the Malawi Investment in Seed Systems and Technology–CIP project to DARS, represented by Mr Chilanga, the station manager for Bvumbwe.

3. REVOLVING FUND

As a project, RTC-ACTION works to ensure availability of planting materials of various classes for dissemination to the farming community. Towards sustaining availability of RTC planting material, a revolving fund has been conceived within the project by crop components (Appendix 3). Y1 and Y2 were basically for restocking of disease-free Mother plants in TC and screenhouses at Bvumbwe. The fund will effectively be implemented in Y3 in partnership with DARS as a key stakeholder. Three years ago the SASHA project worked with DARS to develop a business plan to guide the costing of planting materials across classes and to ensure that seed was available all the time. The business plan will be strengthened and applied.

4. CHALLENGES, SUCCESSES, AND LESSONS LEARNT

The project partners had planned in advance to disseminate planting materials to beneficiaries on time. The season started early and dissemination work was initiated. However, dissemination for cassava and SP halted for some 3 weeks due to mid-season dry spells between January and February. This affected timely distribution of planting materials and establishment of OFTs in some sites. All in all, targets were reached as work continued smoothly when the rains came. Advance planning was key in the year, which needs to be capitalised for timely planting by farmers. Another important approach under implementation is that crop components are establishing multiplication sites within districts of implementation. This will save on transport and time.

The other challenge was prolonged blackout in a number of months in 2017 and 2018. Eight hours of electricity alternated with 26 hours of blackout. As a result OFSP plantlets became weak and were moved to screenhouse for revival and further propagation. Potatoes survived prolonged dark hours in the culture rooms. The lessons are that OFSP plantlets cannot survive prolonged dark hours, but potato had no problems. CIP as an organisation has all Malawi OFSP varieties at KEPHIS, Nairobi, as part of its mandate to preserve key country germplasm in sub-Saharan Africa. New plantlets have already been introduced for preservation and further propagation in the TC lab. Power has since improved with only 6 hours per day of blackout every day.

As a second and sustainable precaution, CIP–Malawi, in partnership with other CIP projects, worked together to empower local capacity to generate own stocks in times of loss. The following are activities that were undertaken:

- Malawi Investment in Seed Systems and Technology project purchased a growth chamber which is used for cleaning of disease in TC.
- SASHA project provided the trainer, Rosemary Gatimu, from KEPHIS, Nairobi. She trained the DARS and CIP technicians on disease-cleaning and how to use the growth chamber.
- RTC-ACTION project is ensuring that the TC lab has reagents and all equipment is functional as work progressed. The technicians have since initiated work towards building own capacity in

germplasm cleaning and maintenance. As the principle is the same, this initiative will also apply to cassava and potato.

As a project, there are a number of successes:

- Three new OFSP varieties were released.
- Production of minitubers increased, ensuring the availability of pre-basic planting materials and therefore dissemination of high-quality planting materials to farmers.
- IITA managed to disseminate planting material to beneficiaries in Y2, although they came on board late. This was through scouting of cassava seed and identifying and disseminating clean planting material despite starting late in the financial year.
- RTC-ACTION project staff were key in hosting two important meetings—namely the MPU CoP and the SP industrial day. These meetings were attended by international delegates and were key to promoting OFSP in Malawi.
- Many seed multipliers benefited in terms of income earned through linkage to seed markets, such that two success stories were developed (see Appendices 4 and 5).
- Bvumbwe had a successful SP open day in June. Senior district agricultural officials were sensitised to prioritise SP extension messages to farmers as well as more, especially on early planting for farmers to realise high yields.

5. RTC-ACTION RISK MANAGEMENT MATRIX

Table 54 provides an analysis of the possible risks and the project approach to manage those risks.

Table 54. Risk management matrix

Risk Category	Description of Risk	Risk Management Strategy	Anticipated Risks	Mitigation
Technical	Development and release of new varieties	Close collaboration with DARS and ministry to ensure realistic and integrated work planning and timely implementation of release steps	DARS failure to release varieties	Capacity building of DARS staff
	Multiplication and dissemination capacity for new varieties	Work with proven private sector multipliers to produce bulk of required quantities at good quality; hands-on support for dissemination in new locations	No reliable market for RTC seed to motivate and sustain farmers	To create awareness to farmers and stakeholders on the advantage of using clean seed
	Farmer adoption of new technologies and varieties	Apply proven participatory selection methodologies during first seasons in representative locations	Less adoption of varieties by farmers	Conduct more awareness and demos in partnerships with key stakeholders and service providers on the advantages of using improved technologies
	Weather and climatic changes	Select multiplication sites to reduce risks from drought and floods; strategically choose evaluation sites to capture potential drought/flood risks	Destruction of planting materials	Empower farmers and partners on specific crop management and improved technologies for use in prone areas

Risk Category	Description of Risk	Risk Management Strategy	Anticipated Risks	Mitigation
		for variety/technology selection; adapt agronomic and seed dissemination strategies to risks from climatic changes		
	Market demand for RTC	Rigorous periodic market assessments for new varieties and products; proactive market development strategy with private sector including diversified market outlets to stimulate demand for nutritious varieties and products	No demand for RTC produce and products	Increased awareness and community sensitisation
	Crop diseases	Select and manage multiplication sites to reduce risks from diseases for seed supply; adapt proven pest management techniques to new locations and include in trainings and extension messages	Loosing seed material due pests and diseases	TC and screenhouse propagation as a back-up and source of nucleus materials; capacity building of DARS staff to carry out disease cleaning processes
Operational	Inflation and exchange rate	Annual reviews of budgets	Staff demotivated	Annual reviews and staff appraisals
	Integration of work plans and joint implementation with DAES and nutrition/health service	Obtain high-level buy-in for collaboration and support through regular feedback; annual joint work planning sessions at local level; quarterly review sessions at local level with all implementing partners	DAES not embracing the project activities	Joint planning and monitoring of project activities at district, EPA, and section level
Strategic	Continued commitment to agricultural diversification and nutrition by Government of Malawi	Continued information and advocacy through RTCDT and donor group	Good policies for other crops and not RTCs	Lobby for policy support of RTCs
	RTCDT viability and effectiveness	Participation on RTCDT board; capacity-strengthening activities; phased transfer of responsibilities with continued oversight	RTCDT not embraced and supported by stakeholders and donors financially and technically	Continued awareness creation on the functions of the Trust and its importance for existence
	Buy-in from additional donors to support scaling-up	Continued information and advocacy through RTCDT and donor group	RTCDT less effective; no interest for affiliation by farmers and organisations	Need to fully operationalise the Trust Awareness creation for increased membership

6. CONCLUSION

The period under the current report covers Y2 activities (April 2017–March 2018) and includes a NCE from April to June 2018. The project activities were successfully implemented for all crop components despite the cassava component joining in August 2018 and mid-season dry spells. Most project targets were delivered for the year. Crop component work plans have already been developed for Y3. Seasonal preparatory meetings will start in September to ensure timely delivery of planting materials.

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ANNEX A

Collection and conservation of neglected root and tuber crops in Malawi. A case for yams (Discorea spp), cocoyams (*Colocasia esculenta* l. and *Xanthosoma sagittifolium* l. Schott) and Livingstone potato (*Plectranthus esculentus* n.e.br)

Malawi is endowed with rich diversity of edible crops for food and nutritional security. These edible crops contribute to the current efforts by Malawi Government of ensuring crop and food diversification (NAIP, 2016). Some of these crops include yams, cocoyams and Livingstone potato. The three crops have proved to be more relevant in addressing food and nutritional security challenges more especially in the current climate change scenarios. However, the three crops are still neglected and underutilized due to limited efforts by research and development institutions to promote their production and utilisation.

Yams have immerse potential to alleviate poverty through increased food availability and sale of surplus produce (Beckford, Campbell, & Barker, 2011). As a crop it is ecologically friendly as it can be produced with minimal external input such fertilizer and chemicals. Yams are a staple food in most parts of Africa and West Africa in particular. Its nutritional composition makes it good as food for people with healthy problems including diabetes (Omohimi et al., 2018). With the increase in diabetic case across the globe, yams can be used as one of the food crop which diabetic people can consume without compromises. Surplus produce is a source of income when commercialized by farmers. Therefore, in Malawi promotion and production of yams may have more benefits to the growing population as malnutrition is becoming a problem.

Cocoyam is another root and tuber crop which contributes to food and income security. The crop has several nutritional benefits due to comparatively rich nutrition composition more especially proteins, vitamins and minerals than other root and tuber crops like potato, sweet potato and cassava (Aregheore & Perera, 2003). Cocoyams contain starch, which makes them an excellent source of carbohydrate. The rich nutritional composition makes the crop a complete meal when consumed by rural people who have limited access to well-balanced food diets. Cocoyams can also be processed into various food products used for industrial and culinary purposes. The starch grains of cocoyam are quite small, which suggests why they aid easy food digestion. Cocoyam is associated with healthy benefits including being suitable for diabetic patients and people with pancreatic, liver and other inflammatory bowel diseases (Awa & Eleazu, 2015). Efforts to promote the production and consumption of cocoyams in Malawi will greatly impact livelihoods of farmers and consumers as the crop is regarded as healthy crop.

Livingston potato (*Plectranthus esculentus)* is a semi cultivated plant species which in some areas is cultivated by farmers whilst in other areas it is harvested from the wild. The plant belongs to a genus Plectranthus which has many species with varying ethnobotanic uses including food and medicinal applications (Lukhoba, Simmonds, & Paton, 2006). In Southern Africa including Malawi, 12 species have been documented for their livelihoods importance with *P. esculentus* having both food and medicinal uses (Rice, Brits, Potgieter, & Van Staden, 2011). The nutritional and medicinal benefits of consuming Livingstone potato are demonstrated by the chemical composition of the tubers. For instance, the chemical analysis of tubers showed that the crop has high content of proteins, crude lipids and total carbohydrates in addition to Iron, calcium and Vitamin A (Temple, Onobun, & Ojobe, 1991). The analyses further showed that the crop has higher levels of seven of the eight essential amino acids than the FAO recommended values. Therefore, consumption of Livingstone potato acts as a source of important food elements which are often deficient in the diet of rural masses in Malawi.

Any efforts leading conservation and sustainable utilisation of the three crops will enormously contribute to current and future agricultural development which will enhance diversification of the food basket for the marginalized farming communities in Malawi. Therefore, the importance of the three selected crops necessitated the implementation of joint germplasm collection mission across the country with the major aim of establishing genepool of all the crops for current and future crop improvement programmes. Specifically, the work aimed at achieving the following objectives:

- To collect and conserve the rich diversity of these three target crops
- To characterize and evaluate the germplasm for further utilisation in research and development

Materials and Methods

The collection mission started with planning session which was done in order to predetermine the possible sites where the target crop species would be found. This exercise involved making direct contacts with Agricultural Extension Staff starting from ADDs, DADOs all the way to Sections.

After the planning sessions two teams were composed to conduct the collection mission one for the South and part of Central region and the other one for the North and also part of central region. The teams had experts from Roots and Tubers Section and Malawi Plant Genetic Resources Centre (MPGRC). The Roots and Tubers experts provided technical expertise on the identification of the target crops while MPGRC staff provided technical expertise on the collection procedures.

The teams started off for the collection mission on 26th December, 2017 and finished on 4th January, 2018. The collection mission involved documentation of ethnobotanical and geographical information associated with each sample. The information was recorded using a standard germplasm collection form developed by the SADC Plant Genetic Resources Centre (SPGRC). The geographical coordinates were captured using GPS which were further used in plotting distribution map of the collected samples using DIVA GIS system, a free GIS system for the analysis of germplasm

Results

A total of 125 accessions of the yams and cocoyams were collected. Among the 125 accessions, 70 were for cocoyams, 51 for ground yams and 4 for air yams. The Livingstone potato was collected in June and a report is being prepared. In terms of crop specific collections, a lot of cocoyam samples were collected from Machinga while a lot of yam samples were collected from Nkhatabay. Chikwawa, Kasungu, Ntcheu and Phalombe only registered cocoyams while Dedza registered yams only. The other districts registered both yam and cocoyam samples.

Way forward

A work plan and budget have been developed to finalise collection in districts which were missed during the first phase. Secondly, the collected accessions will be subjected to agronomic and nutritional characterisation for further use in research and development of these crops. Partners involved will include: DARS gene bank for germplasm preservation, phonotypic and agronomic characterisation. Luanar and Chancellor College for nutritional characterisation. Further research is warranted to determine the role of these crops in communities and their contribution to resilience and livelihood.

APPENDIX 1A: BENEFICIARIES DISAGGREGATED BY GENDER DISTRICT AND CROP

	Cassava			Potato			Sweetpotato		
Row Labels	**F**	**M**	**Total**	**F**	**M**	**Total**	**F**	**M**	**Total**
Blantyre							2221	1006	3227
Chikwawa							705	847	1552
Chiradzulu							1460	660	2120
Dedza				687	513	1200			
Dowa				233	755	988			
Kasungu	650	1413	2063	496	592	1088			
Lilongwe East	322	577	899	418	482	900			
Lilongwe West	267	795	1062	456	418	874			
Mangochi	1018	1042	2060						
Mchinji				81	333	414			
Mulanje							3379	1170	4549
MWANZA							252	209	461
Mzimba North	681	1237	1918						
Mzimba South				426	517	943			
Mzimba South	477	1144	1621						
Neno				112	132	244	416	64	480
Nkhatabay	749	826	1575						
Nsanje							2529	1424	3953
Ntcheu				453	706	1159			
Ntchisi				312	566	878			
Phalombe							606	411	1017
Thyolo				275	378	653	684	226	910
Zomba							1261	771	2032
Grand Total	**4164**	**7034**	**11198**	**3949**	**5392**	**9341**	**13513**	**6788**	**20301**

APPENDIX 1B: LOCATION OF BENEFICIARIES IN THE DISTRICTS AND CROP

Crop	District	No. of EPAs	No. of Section	No. of Villages
Potato	Dedza	2	6	75
	Dowa	3	17	275
	Kasungu	2	13	122
	Lilongwe East	2	6	201
	Lilongwe West	1	14	135
	Mchinji	1	5	68
	Mzimba South	3	8	44
	Neno	1	3	5
	Ntcheu	3	6	27
	Ntchisi	2	10	169
	Thyolo	2	6	20
	Total	**22**	**94**	**1141**
Sweetpotato	Blantyre	3	12	123
	Chikwawa	3	23	127
	Chiradzulu	2	12	134
	Mulanje	4	17	115
	Mwanza	2	8	41
	Neno	1	5	16
	Nsanje	10	25	381
	Phalombe	2	10	61
	Thyolo	2	9	17
	Zomba	4	22	162
	Total	**33**	**143**	**1177**
Cassava	Kasungu	6	46	215
	Lilongwe East	2	1	172
	Lilongwe West	3	35	336
	Mangochi	4	20	109
	Mzimba North	10	34	355
	Mzimba South	5	30	276
	Nkhata Bay	6	30	139
	Total	**36**	**196**	**1602**
	Grand Total	**91**	**433**	**3920**

APPENDIX 2. NUMBER OF CARE-GROUPS AND CLUSTER LEADERS REACHED WITH OFSP NUTRITION ACTIVITIES

No.	Care group Name	No. of Cluster Leaders Trained			District	EPA
		Male	Female	Total		
1	Kanene	0	10	10	Zomba	Thondwe
2	Tiyanjane	0	8	8	Zomba	Thondwe
3	Nagogoda	0	1	1	Zomba	Thondwe
4	Mpata	0	8	8	Zomba	Thondwe
5	Talandira	0	7	7	Zomba	Thondwe
6	Tilimbike	0	2	2	Zomba	Thondwe
7	Chikwekwe	0	2	2	Zomba	Thondwe
8	Tikondane	0	1	1	Zomba	Thondwe
9	Tikondane 1	0	9	9	Blantyre	Ntonda
10	Tikondane 2	2	8	10	Blantyre	Ntonda
11	Kuyola 1	0	8	8	Blantyre	Ntonda
12	Kuyola 2	0	8	8	Blantyre	Ntonda
13	Tiyanjane	0	7	7	Blantyre	Ntonda
14	Chibwana	0	1	1	Thyolo	Centre
15	Chigwirizano	0	6	6	Thyolo	Centre
16	Matamando	0	6	6	Thyolo	Centre
17	Tikondane	1	3	4	Thyolo	Centre
18	Chiyanjano	2	2	4	Thyolo	Centre
19	Titukulane	0	3	3	Thyolo	Centre
20	Mwaiwathu	0	4	4	Thyolo	Centre
21	Talandira	0	2	2	Thyolo	Centre
22	Tiyanjane	0	3	3	Thyolo	Centre
23	Tigwirizane	0	3	3	Thyolo	Centre
24	Chisomo	0	1	1	Thyolo	Centre
25	Madalitso	0	10	10	Chiradzulu	Thumbwe
26	Tifatse	1	4	5	Chiradzulu	Thumbwe
27	Mulinde	0	4	4	Chiradzulu	Thumbwe
28	Madulira	2	0	2	Chiradzulu	Thumbwe
29	Tavomereza	1	4	5	Chiradzulu	Thumbwe
30	Chalamanda	0	1	1	Chiradzulu	Thumbwe
31	Tikondane	0	3	3	Chiradzulu	Thumbwe
32	Muhasuwa	0	5	5	Chiradzulu	Thumbwe
33	Chisomo	1	2	3	Chiradzulu	Thumbwe
34	Chimwemwe	0	2	2	Chiradzulu	Thumbwe
35	Mombo	0	3	3	Chiradzulu	Thumbwe
36	Takondwa	0	1	1	Chiradzulu	Thumbwe
37	Mgwirizano	0	13	13	Chikwawa	Mitole
38	Tilimbike	0	7	7	Chikwawa	Mitole
39	Tiyanjane	0	13	13	Chikwawa	Mitole
40	Mtondo	0	12	12	Chikwawa	Mitole
41	Talandira 1	0	8	8	Mulanje	Boma
42	Talandira 2	0	9	9	Mulanje	Boma
43	Tagwirizana	0	8	8	Mulanje	Boma
44	Nkuntha	0	7	7	Mulanje	Boma
45	Tithokoze	0	6	6	Mulanje	Boma
Total		**10**	**235**	**245**		

The International Potato Center (known by its Spanish acronym CIP) is a research-for-development organization with a focus on potato, sweetpotato, and Andean roots and tubers. CIP is dedicated to delivering sustainable science-based solutions to the pressing world issues of hunger, poverty, gender equity, climate change, and the preservation of our Earth's fragile biodiversity and natural resources.
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