REPORT

CGIAR Contribution to KULIMA Promoting Farming in Malawi: Improving the Access to and Use of Agriculture Research Innovations by Malawian Farmers

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Cover Photo: Members of a farmer field school in Tayambapo harvesting potatoes on 14 April 2021.

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Acronyms

ABC	Alliance of Bioversity and CIAT
ADD	Agricultural Development Division
AEZ	Agro-ecological zone
CA	Conservation agriculture
CBF	Community-based facilitator
CCA	Climate change adaptation
CGIAR	Global Agricultural Research Partnership
CIAT	International Center for Tropical Agriculture
CIMMYT	International Maize and Wheat Improvement Center
CIP	International Potato Center
COGs	Community outreach groups
DARS	Department of Agricultural Research Services
DTM	Drought-tolerant maize
EPA	Extension Planning Area
EU	European Union
FAW	Fall army worm
FAO	Food and Agriculture Organization of the United Nations
FFS	Farmer field school
FPTE	Farmer participatory technology evaluation
GIZ	Gesellschaft für Internationale Zusammenarbeit GmbH
GoM	Government of Malawi
ICRAF	World Agroforestry Center
ICRISAT	International Crop Research Institute for the Semi-Arid Tropics
IITA	International Institute for Tropical Agriculture
IMTs	Improved management technologies
KULIMA	Kutukula Ulimi m'Malawi (promoting farming in Malawi)
M&E	Monitoring and evaluation
MT	Master trainer

NCE	No-cost extension
NRM	Natural resource management
OFSP	Orange-fleshed sweetpotato
QPM	Quality protein maize
RA	Result area
RTC	Residential training center
SMS	Subject matter specialists
SO	Specific objective
VC	Value chain
WFC	World Fish Center

Project Overview

This report summarizes the progress of implementing the CGIAR KULIMA[1] phase 2 project (1 January–30 June 2021). The 28-month project (1 January 2020 –31 March 2022) is funded by the European Union (EU) through the Gesellschaft für Internationale Zusammenarbeit GmbH (GIZ) and is co-funded by the German Cooperation for the GIZ implementation component. It is a six-year EU-government of Malawi partnership that is being implemented by GIZ, the Food and Agriculture Organization of the United Nations, and a consortium of NGOs led by Self Help Africa. The International Potato Center is coordinating the contribution of seven CGIAR (CG) centers under the coordination of GIZ:

- Alliance Bioversity–International Center for Tropical Agriculture
- International Maize and Wheat Improvement Center
- International Centre for Research in Agroforestry
- International Crop Research Institute for the Semi-Arid Tropics
- International Institute for Tropical Agriculture
- World Fish Center

This CIP-led component of KULIMA phase II is funded at €2,959,500.

KULIMA action objectives

The overall objective of the six-year KULIMA project is to promote sustainable agricultural growth to increase incomes, employment, and food security in Malawi in the context of a changing climate. The project has three specific objectives (SOs) with different result areas (RAs).

SO1: Agricultural productivity increased, and production diversified in a participatory, sustainable, and climate-change-resilient manner

RA 1.1: Improved organization and delivery of national research and extension services

RA 1.2: Supply system of appropriate inputs and related technologies set up and meeting the needs to ensure increased, diversified, and sustainable production

RA 1.3: Farmers mobilized and supported to boost their agricultural production

RA 1.4: Government efficiently supported to increase investment for irrigation development

SO2: Agricultural value chains developed or established and related income and employment opportunities created

RA 2.1: Affordable loans made available to private sector-managed, demand-driven agricultural investments and used by value chain actors for expanding operations, including smallholders' operations

RA 2.2: Value chain development plans for selected crops and other commodities developed and implemented, leading to increased, sustainable, and environmentally friendly growth in primary production, value-adding, and viable enterprises in the value chain

1. *Kutukula Ulimi m'Malawi*, or Promoting Farming in Malawi.

SO3: Agriculture sector governance is strengthened

RA 3.1: The wider public is better informed and consulted on key issues in agriculture

RA 3.2: Strengthened accountability role of the Malawian Parliament on agriculture and agriculture-related issues

In this project, CG centers are mainly contributing to **SO1** of the broader KULIMA program that seeks to increase agricultural productivity and diversification through systematic deployment and upscaling of climate-smart agriculture technologies in a participatory and sustainable manner. Specifically, CG centers are contributing to the key RAs 1.1 and 1.2 of SO1 that focus on strengthening the organization and delivery mechanism of national agricultural research and extension services, in addition to improving the supply systems of appropriate information, knowledge, technologies, and inputs to smallholder farmers across the KULIMA districts.

Key CGIAR contributions to KULIMA

The project is being implemented in 10 districts: Chitipa, Karonga, Nkhata Bay, Mzimba, Kasungu, Nkhotakota, Salima, Chiradzulu, Thyolo, and Mulanje. CGIAR's key responsibilities include:

- Develop and print technical content for farmer field school modules
- Train master trainers (MTs) at three residential training centers (RTCs)
- Procure inputs and establish study plots at RTCs and 15 outreach locations
- Conduct follow-up coaching for MTs (on demand)
- Assess farmers' perceptions of technology and resulting adaptation needs
- Conduct further research on the selected technologies, innovations, and practices
- Develop and share communications/project briefs
- Provide advisory services on technologies, innovations, and practices to selected producers/ enterprises
- Support concrete partnerships for sustainable planting material supply system
- Train and support multipliers/suppliers of seeds/planting material/inputs in KULIMA districts
- Contribute to implementation and evaluation of integrated technology packages
- Facilitate the participation of Department of Agricultural Research Services staff in the activities
- Provide starter kits for training community-based facilitators by MTs (coordinated by CIP)

1. Overall project progress and achievements

This report summarizes the activities undertaken and progress made in the first six months (1 January–30 June 2021) of year 2 of implementing the KULIMA phase 2 project. The project is funded by the European Union (EU) through the Gesellschaft für Internationale Zusammenarbeit GmbH (GIZ) and is co-funded by the German Cooperation for the GIZ implementation component. It is a six-year EU-government of Malawi (GoM) partnership that is being implemented by GIZ, the Food and Agriculture Organization of the United Nations (FAO), and a consortium of NGOs. The International Potato Center (CIP) is coordinating the contribution of seven CGIAR (CG) centers under the coordination of GIZ

1.1 Executive summary of progress and achievements

During the reporting period, the project team continued to make progress in the implementation of key project activities, building on the achievements made during the previous reporting period. Despite the challenges posed by the COVID-19 pandemic, the team maintained the momentum of implementation. The project aimed to create more sustainable impacts among smallholder farmers through the implementation of the following activities: (1) farmer participatory technology evaluation (FPTE), (2) harvesting of technology study plots, (3) training of master trainers (MTs), (4) seed production and distribution, and (5) field monitoring and supervisory visits. Through these activities the project recorded many achievements, among them were (1) completion of the third cohort of an MT training program; (2) conducting FPTEs at three residential training centers (RTCs) and many outreach locations; (3) participatory harvesting and data collection of the study plots; (4) distribution of training materials to the third cohort of MTs; (5) harvesting and processing of seed of various crops; and (6) carrying out a series of media engagement and interaction. The results obtained from the FPTEs revealed that farmers' preference for integrated technologies varied from location to location as well as criteria used for selection. Gender differences were also observed in the selection of different technology options.

The results obtained from **soybean**-based technology indicated that 'Tikolore' was the most preferred soybean variety, being ranked the best by 39.7% of the farmers in Thuchila, 67.9% in Lisasadzi, and 42.9% in Mzuzu for its early maturity and high pod yield. Similarly, IT82E16 was the most preferred **cowpea** variety, with more than 80% of the farmers selecting it for its early maturity and high pod yield. However, 72.9% of the farmers in Thuchila and 66.6% in Lisasadzi preferred growing cowpea in sole stands for high pod yield. For **cassava**-based technology, Mbundumali was the most preferred variety with 67.8% of farmers in Thuchila, 62.6% in Lisasadzi and 42.9% in Mzuzu selecting it for its good plant establishment, good plant vigor, suitability for leaf vegetable, and tolerance to termite damage. An assessment of farmers' preference for **fertilizer trees** revealed that they preferred to plant Gliricidia, Tephrosia, and *Sesbania Sesban*. This was because once the variety is planted and well established, after two years farmers will only be harvesting the biomass for incorporation. This differs from other non-coppicing fertilizer trees, which are supposed to be planted every rainy season, thus posing a challenge when there is drought. The results obtained from farmer's evaluation of drought-tolerant and nutritious **maize** varieties showed that MH40A, MH36, and MH43A were the overall preferred varieties. Grain color (orange or white) was not a very important trait by farmers in the evaluation process. With **potato**, 'Rosita' was the most preferred variety by farmers across the three RTCs due to the high yield and good quality of its tubers. Among the six **orange-fleshed sweetpotato** (OFSP) varieties that were evaluated, 'Chipika' was the most preferred variety at Thuchira RTC and its community outreach locations. Farmers and MTs at Lisasadzi RTC showed strong preference for

'Mathuthu' variety due to its high root number, big root size, and high yield. In Mzuzu RTC, 'Royal Choice' was the most preferred variety for its smooth tuber, high root number, big root size, and overall root yield. At Thuchila RTC, SER 124 was the most-preferred **bean** variety, followed by SAA 20 and NUA 45. At Lisasadzi RTC, both male and female farmers selected NUA 45 as the most preferred variety, followed by SAA 20 and SER 124. Across nine outreach sites at Mzuzu RTC, NUA 45 was the most preferred variety, followed by Napilira and SAA 20. The overall yield results obtained from OFSP study plots indicated that Lisasadzi RTC recorded higher yields for almost all the varieties, followed by Thuchila RTC; the lowest yields were obtained from Mzuzu RTC. The results obtained from the potato-based technology across the three RTCs indicated that 'Rosita' was the best-performing variety, followed by Chuma and Violet. Yield performance of **groundnut** varieties obtained at Lisasadzi RTC and selected outreach sites revealed that CG 13 had the highest yield (1,251.0 kg/ha), followed by 1,174 kg/ha from CG 9 and 1,044 kg/ha for 'Chalimabana', a local variety. The farmers' feedback from the technology evaluation will be used to fine-tune the technology packages to ensure that the technologies are more tailored toward the technology needs of farmers.

1.2 Detailed reporting on the project achievements

This section describes in detail achievements relating to activities under each SO and crosscutting issues such as project coordination, monitoring and evaluation (M&E), communication, and visibility.

RA 1: Improved organization and delivery of national research and extension services

Main activity 1.1: Identify innovations/technologies available and adapted for each agro-ecological zone (AEZ) of Malawi

Sub-activity 1.1.1: *Map existing innovations/technologies for each AEZ of Malawi, including an assessment of availability of innovations/technologies to determine possible gaps*

Given the complex and diversified cropping systems with wide range of farming environments, it is important to map the available integrated technologies/innovations across various AEZs that represent the variation in climatic, soil, biotic, and cropping systems. Hence, the existing integrated technology options were selected and mapped to different AEZs during the first phase of the project. Following the successful mapping of these technologies to their areas of adaptation, CG centers continued to deploy various integrated technology options that can significantly improve smallholder agricultural production systems across three RTCs (i.e., Mzuzu, Lisasadzi, and Thuchila) and 30 farmer field school (FFS) outreach locations. MTs, community-based facilitators (CBFs), and farmers continued to be involved in the participatory evaluation of the technologies. The aim was to see how the technologies/ innovations are performing and their potential economic benefits through field observation; systematic dialogue between farmers and scientists; and quantitative and qualitative technology assessments. The detailed accounts of the existing integrated technology options mapped to various AEZs were documented in the previous report (1 July–31 December 2000).

Sub-activity 1.1.2: *Develop integrated technology packages to be used for the training/capacity building in a learning-by-doing process*

During the reporting period, the project continued to implement the existing integrated technology packages developed during the first phase. However, a new pond-based hatchery integrated with banana and vegetables package was developed and demonstrated for training at Mulanje FFS during this period. The fish hatchery integration aims to create sustainable availability and accessibility of

good quality fingerlings within the community and provide a source for complete diets through consumption of vegetables and banana fruits.

Sub-activity 1.1.3: *Develop a joint "strategic plan" for rolling out the innovations and technologies, including natural resource management (NRM) practices, to the three RTCs and 30 outreach locations*

A series of virtual coordination meetings were held with GIZ, FAO, and the NGO consortium during the reporting period to enhance collaboration and coordination among different implementing partners. Specifically, meetings/events were held: (1) seed multiplier and agro-dealer meeting, (2) project technical review and planning meeting; and (3) EU-ROM (results oriented monitoring) review meeting.

CG centers attended a virtual meeting convened by GIZ–Green Innovation Centers for the Agricultural and Food Sector (GIZ–GIAE) on 11 February 2021 to discuss agro-dealer and seed multiplication activities for the year. At the meeting it was agreed to conduct refresher training for agro-dealers, including new ones, and explore potential collaboration with Rural Market Development Trust and Seed Trade Association of Malawi. A virtual project technical meeting was organized on 28 May 2021 to review progress, identify challenges, and reflect on the lessons learned to enhance the impacts of the project intervention. The meeting also discussed the completion of the training program for the third cohort of the MTs and the establishment of winter study plots across the three RTCs. It was also agreed to hold the technology result dissemination workshop in August after all the 2020–2021 data would have been collected and analyzed. Additionally, CGIAR attended the virtual external ROM review meeting on 18 June 2021. The meeting aimed to provide answers/clarifications to some of the emerging issues that ensued during the visit of the ROM expert to the project sites.

Sub-activity 1.1.4: *Monitoring visit to provide technical backstop to MTs, CBFs, and FFS on the implementation of project activities*

During the reporting period, CG centers conducted monitoring and supervisory visits to RTCs and outreach sites to monitor the general performance of the integrated/crop specific technologies, and provided technical backstop to the MTs and CBFs on the management of the study plot established during the 2020–2021 cropping season. The highlights of the key observations made by each CG center are as follows:

- **CIMMYT** observed that some varieties of maize were affected by fall armyworm (FAW) at Mchikumbe in Mulanje; however, MH40A and MH43A showed better tolerance to the FAW. Similarly, during the first monitoring visit to Kasungu in January 2021, the study plots were observed to be well managed with very few weeds in the conservation agriculture (CA) plots. Unfortunately, during the second monitoring visit, plots were completely abandoned. This was observed at Kamwankhuku FFS in Kasungu, where the maize plots were very weedy, especially in the CA plots. The problem was due to the members of the FFS group being busy and overwhelmed with work in their own fields and thus could not allocate time to weed the study plots.
- **IITA** made monitoring visits to the RTCs and outreach locations. Germination/establishment was generally good (80% and above) at all the study plots, as most fields were well weeded except at Mzuzu RTC, Kanyenda FFS in Mzuzu; Mgwirizano, Chingati, and Chamkoko FFS in Kasungu; and Nunkhire, Tigwirizane-Mtambo, and Ankaziwandani FFS in Mulanje. Cowpea and maize were the most affected by the insect pests. Appropriate pesticides (i.e., Cypermethrin and Proclaim Fit) were provided for the control in the respective crops.

- **Alliance of Bioversity and CIAT (ABC**) conducted monitoring visits to various project sites from 29 January to 9 February 2021 to assess the status of the common bean on the study plots at the RTCs, community outreach groups (COGs), and seed multiplication plots. The crop stands at the three RTCs were very good; however, some study plots at the COGs of Thuchila RTC were heavily affected by droughts in some areas and bean stem maggots in others due to a short dry-spell period that resulted from uneven distribution of rainfall. In the outreach sites under the Mzuzu RTC, particularly Luanatonga FFS, Tata FFS, and Chilimbilano FFS were affected by persistent rainfall. As regard to the variety performance at FFS plots, SER 124 and SAA 20 varieties were performing much better than the other two varieties (NUA 45 and Napilra). Plots fertilized with manure had good crop stand, just as did those fertilized with chemical fertilizer.
- **CIP** conducted monitoring visits to all the RTCs and outreach locations to assess crop establishment and occurrence of diseases on potatoes. Good crop establishment was observed at both RTCs and COGs; however, poor sprouting had occurred on some of the potato varieties across some outreach locations. The poorly sprouted seed was immediately replaced with another seed from other varieties as seed of many of the poorly sprouted varieties were not available. Pest and disease damage were also seen on potato study plots in many of the outreach locations. Appropriate chemicals (i.e., Dithiane and Cypermethrin) were provided for their control.
- **ICRISAT** conducted field monitoring to assess the performance of both integrated and crop-specific technologies. The following observations were made: (1) the groundnuts study plots across the three RTCs were well-established and crop development was generally good in all the plots; (2) the pigeonpea study plot recorded good establishment, and crop performance was very good in all the sites; and (3) the groundnut and pigeonpea doubled-up system study plot was doing well in all the locations visited.
- **ICRAF** conducted field M&E activities in Kasungu (Lisasadzi RTC and Msambamfumu FFS) and Thuchila and Mzuzu RTCs. With over 300 farmers, World Agroforestry Center (ICRAF), together with the MTS, CBFs, and the KULIMA program's participating farmers took time to showcase and explain to the attendees the agroforestry technologies being promoted, how the tree-based green manure biomass is used for incorporation, and benefits of using this agroforestry technologies under a changing climate.

Main activity 1.2: Train extension workers and lead farmers with the FFS approach to improve quality and accessibility of the national extension system.

The CGIAR contribution under this activity is to train government extension staff (MTs) on the wide range of integrated technology packages that is being promoted across the three target RTCs. The training program aimed to equip the MTs with the practical knowledge and skills required to facilitate the training of CBFs and farmers on these packages. The training of the third cohort of MTs began in February 2021, but was suspended due to the outbreak of COVID-19. The restrictions imposed by the government to contain the spread of the pandemic led to the closure of the three RTCs. The MTs, however, returned to classes in April 2021 after the government eased it COVID-19 restrictions on physical gatherings. Prior to the resumption of the training program, the training schedule detailing dates and time slots allocated to each curriculum was reviewed and finalized by FAO in consultation with CG centers and the Department of Extension Services. The training at Lisasadzi RTC and Mzuzu RTC opened on 19 April 2021, and the course started on 14 June 2021 at Thuchila. Sixty extension workers were trained (48 men, 12 women).

Sub-activity 1.2.1: *Develop technical content to be included in the FFS modules (innovation and technologies and NRM/climate change adaptation practices [CCA])*

Enhancing the knowledge and skills of MTs across a wide range of agricultural technologies for effective delivery of technology packages to the CBFs and farmers will require the development of training manuals that are well-articulated and easy to read. Hence, one of the key achievements under this sub-activity was the printing and distribution of training manuals to the MTs across the three RTCs. Previously, training manuals were developed by all the implementing CG centers to cover all the aspects of crop-specific and integrated technology options being promoted under the KULIMA project. During this period, 1,010 training manuals packaged with detailed information to serve as reference materials were printed and distributed by CIP to the 90 MTs to serve as reference materials during the training of CBFs (Appendix A).

Sub-activity 1.2.2: *Train MTs on innovation and technologies (seed/input production and management) and NRM/CCA practices*

Following the resumption of the MT's training program at the three RTCs, the CG centers took turns at training the MTs on the integrated technology packages to build new knowledge, skills, technologies, and approaches into the national extension services at the RTCs. During the training, various approaches such as PowerPoint presentations, interactive lectures, hands-on practical exercise, and field visits were used to successfully deliver the training modules to the MTs (Table 1). In compliance with COVID-19 preventive measures, the training in Mzuzu was conducted twice. Only 15 MTs per training schedule were present as the RTC could not accommodate all 30 MTs at once due to limited space.

Table 1. The training schedules for the third cohort of MTs (2021)

CG Centers	Training of MTS at the RTCs			No. of MTs Trained		Total
	Thuchila	Lisasadzi	Mzuzu	Men	Women	
CIP	—	3 and 7 June	24 May and 7 June	48 (25 Mzuzu, 23 Lisasadzi)	12 (5 Mzuzu, 7 Lisasadzi)	**60**
CIMMYT	—	4 and 10 June	27 May and 10 June	35 (25 Lisasadzi, 12 Mzuzu	11 (8 Lisasadzi, 3 Mzuzu)	**47**
IITA	—	23 April, 2 and 7 June	26 May and 9 June	33 (22 Lisasadzi, 11 Mzuzu)	10(7 Lisasadzi, 3 Mzuzu)	**43**
ICRISAT		11 June	8 June			
CIAT	—	1 June	—	21	6	**27**
ICRAF	—	8 June	11 June			
WFC	12–13 July	—	—	17	16	**33**

The highlights of the training sessions covered by each CGIAR center are as follows:

- **CIMMYT** delivered the training sessions for the third cohort of MTs in collaboration with the Department of Agricultural Research Services (DARS). Training was delivered on the significance of drought-tolerant maize (DTM) varieties and CA as a complementary climate-smart agriculture technology package to sustainably increase maize productivity and production in the face of droughts. Drought tolerance in maize was explained and examples of DTM varieties in Malawi were provided to the participants. Practical sessions were also included for the CA training specifically to demonstrate soil aggregate stability. This was chosen as a simplest approach which

the MTs can use to help convince farmers to adopt CA instead of ridge and furrow practice or conventional ridge practice.

- **CIP** trained 60 MTs (48 men, 12 women) on 24 May and 9 June 2021 in Mzuzu and Lisasadzi, respectively. The sessions covered sweetpotato and potato production practices, harvest and postharvest handling, and seed production systems. The training featured hands-on practical sessions on the construction of sweetpotato storage pit (also called "ladder pit"), land preparation for potato and sweetpotato roots/tubers production, as well as seed multiplication. The MTs were also guided on how to apply fertilizer to potato at planting and three weeks to one month after planting as top dressing.
- **ABC** trained the MTs across the three RTCs on common bean production and integrated soil fertility and water management. The topics covered included field operations, variety selection, seed quality; site selection; land preparation; planting; weed control; pests and disease control; and harvesting and post-harvest operations.
- **ICRAF** trained the MTs on agroforestry principles and practices. In Thuchila and Mzuzu RTC, the training covered fruit tree propagation techniques, soil health, CA with trees, and principles and practices of agroforestry. In Lisasadzi, the MTs were introduced to common practices for soil fertility improvement, fruit tree establishment (including propagation), farmer-managed natural regenerations, and fodder production. In Mzuzu MTs were trained on fruit tree propagation.
- **ICRISAT** trained MTs on production principles of its mandate crops (pigeonpea, groundnut, sorghum, and finger millet). The scheduling delivery of training modules followed the curriculum developed by FAO.
- **IITA** trained MTs on economic importance of cassava, soybean, and cowpea crops; seed quality assurance; agronomic practices; postharvest handling; and seed certification. Topics on aflatoxins mitigation included introduction to aflatoxins (what they are, their economic importance, and their spread); regulatory limits; preharvest (use of Aflasafe and good agronomic practices) and postharvest mitigation measures; sampling; and testing for contamination.
- **WFC** contributed to the training in Thuchila RTC of 33 MTs (22 men, 11 women) including seven youths. Topics covered pond designs and construction; fish species and their potentials; feeds and feeding; fish breeding and nursery management; integrated agriculture aquaculture; fish harvesting, processing, and marketing; fish health; and practical training on fish species identification, sex determination, and feed formulation. All MTs were provided with a fish-farming gold standards manual (31 present and two with apologies). The MTs conducted practical sessions at the KULIMA hatchery operators farm within Thuchila and managed to both identify fish sex species and produce 25 kg of locally produced feed at 32% crude protein content level. The feed was then left with the farmers to dry and feed it to their fish.

Other training programs conducted by the CG centers comprise the following:

- **Training of subject matter specialists (SMS)**. On 26 March 2021 at Lilongwe Hotel, district agricultural crop SMS from Mzuzu, Kasungu, and Blantyre were trained on study plot-harvesting techniques. The participants comprised nine crops officers (six men, three women) from the three Agricultural Development Divisions (ADDs) as well as the principals from the RTCs. This was part of a contingency plan to equip the SMS with practical knowledge and skills required to competently harvest the study plots in case CG centers cannot participate in the field activity in view of a predicted third wave of COVID-19. The SMS are expected to provide technical backstopping of the

MTs to harvest all the study plots in the respective ADDs. All the implementing CG centers took turns training the SMS on the procedures for study plot-harvesting and data collection for all the promoted integrated technologies.

Sub-activity 1.2.3: *Acquire and provide the required quality inputs to be used for the practical training with establishment of trials in study plots (at RTCs, 30 outreach locations and up to 80 training sites per season where MTs will be training CBFs)*

In the previous quarters, CGIAR established a wide range of integrated technology study plots across the three RTCs and 30 FFS sites. During the reporting period, WFC established a new pond-based hatchery in Mulanje at the Thuchila RTC. The pond was stocked with 274 brood stocks of *Oreochromis shiranus* (187 females, 87 males) to create sustainable access to good quality fingerlings/seed within the community. Within 14 days, 2,700 healthy fingerlings were harvested from the hatchery, and the hatchery was immediately restocked to maintain continuous production of fingerlings.

Similarly, the three ponds established in Kululira Village in Mulanje at Thuchila RTC were stocked with 7,200 *O. shiranus* fingerlings at a rate of six fish/m^2 to study the effect of different feed formulations on fish growth and performance. The experimental setup consists of two treatments and one control. In the first treatment, fish are being fed on formulated floating feed; in the second experiment, fish are being fed with local maize bran; and in the control, natural feed after manure application will be tested. The participatory evaluations that have been conducted have made the CBFs appreciate the use of supplementary feeding over natural production and the use of formulated floating feed over the local maize bran for growth performance results.

A pond-based hatchery that was stocked with 274 brood stock (187 females, 87 males) in Mulanje at Thuchila RTC in the last quarter has produced and sold 18,500 fingerlings of *O. shiranus* to a farmer in Lilongwe who is on contract farming with Maldeco Fisheries.

In Mpamba section of Nkhata-Bay at Mzuzu RTC, five FFS study pond sites (i.e., Mukukwi, Kalundi Msukwa, Shadreck Kanyika, Agness Munkhondiya, and Finiyasi Kaifa) were stocked with fingerlings on 12 June 2021. Ten ponds were stocked with 12, 000 fingerlings of *O. shiranus* and 12,000 fingerlings of *Coptodon rendalli*. The objective of the study ponds is to enable the FFS groups to observe the growth rate performance of two species of fish stocked so that they can choose a species that best suits their AEZ.

Main activity 1.3: Supporting basic and applied research for addressing needs identified through FFS participatory research activities

Addressing the technology needs of FFS groups through basic research will require a participatory approach that links farm-level diagnosis and identification of farmers' constraints to the scientific understanding of these constraints. Therefore, FPTE and farmers' technology preference assessment were conducted during the reporting period to obtain farmers' perceptions and feedback on the crop-specific and integrated technologies that are being promoted by various CG centers. The results of the FPTE sessions and farmers' technology preferences are highlighted under the following sub-activities.

Sub-activity 1.3.1: *Assess innovation adoption rates and adaptation needs (study)*

A consultant was engaged to conduct farmers' technology assessment and adoption surveys across the three RTCs and selected outreach sites. This activity was done to capture farmers' perceptions on the wide range of integrated technologies that are being promoted by the CG center to improve farm

productivity. The survey was conducted on 4–25 May 2021. A report of this survey is being compiled and will be shared with GIZ and partners by 15 September 2021.

Sub-activity 1.3.2: Participatory technology evaluation with MTs, CBFs, and FFS groups

One of KULIMA's objectives is to deliver integrated technology options with potential to sustainably increase farm productivity, income, food, and nutrition security to smallholder farmers. Therefore the project's multidisciplinary team continued to work with MTs and FFS groups to demonstrate the agronomic and economic potentials of the integrated technology options through the establishment of technology study plots and FPTEs. Through the study plots, MTs and FFS groups were exposed to a diversity of technology options and had the opportunity to learn and observe the positive effects of the integrated technologies and their potential economic benefits. To obtain feedback from farmers on the technologies/innovations, FPTE sessions were held at the three RTCs and outreach locations. The methods and tools used to assess and capture farmers' perceptions, their criteria used for selection, and how they vary from region to region include pairwise ranking, structured questionnaires, focus group discussions, voting, and ranking. These methods were adapted to the type and composition of the technology options being promoted.

Important insights were gained through these FPTEs, as farmers expressed distinct preferences and different perceptions of the value of promoted technologies for addressing their production constraints. The FPTEs and preferences varied across locations and between women and men. The results will be used to fine-tune the technology packages in order to make the technologies more responsive to the technology needs of both women and men. The highlights of the feedback from farmers are documented as follows.

- **ICRAF** conducted FPTEs in agroforestry technologies in Kasungu and Nkhata Bay FFS. A total of 361 (132 men, 229 women) farmer members participated at Lisasadzi and Mzuzu RTCs. The feedback received revealed that farmers preferred to plant Gliricidia, Tephrosia, and *Sesbania Sesban* because, once it is planted and well established, after two years farmers will only be harvesting the biomass for incorporation. This differs from other non-coppicing fertilizer trees which are supposed to be planted every rainy season which are supposed to be planted every rainy season, thus posing a challenge when there is drought. Farmers also appreciated the multiple uses of the agroforestry trees, including that of reducing pest infestation, including FAW.
- **CIMMYT** conducted FPTEs with FFS in Thuchila, Lisasadzi, and Mzuzu RTCs (Photo 1). The results indicated that farmers' preference for varieties varied from one location to another, and showed that MH40A, MH36, and MH43A were the overall preferred maize varieties (Figure 1). On the other hand, Chitedze 2 quality protein maize (QPM) and MH 44A were the least-preferred varieties. Farmers used different traits to select the preferred varieties—mostly productivity/yield traits, big ears, and good grain-filling. Grain properties like the texture of the grain and size were very important in determining preference. Mostly farmers liked flint-grain texture rather than dent-grain texture, as well as large, shiny, and healthy-looking grains. Farmers observed that the varieties with large-flint textured kernels could weigh more than those with dent grains. In contrast, female farmers indicated that shiny and flint-textured grain was a desired trait when processing maize as it enhances poundability. Grain color (orange or white) was not a very important trait by farmers in the evaluation process. CA and/or intercropping pigeonpea in the maize plots was a preferred cropping practice in Mulanje and Kasungu, whereas production of maize as a sole crop was preferred in Mzuzu. The best-preferred varieties for the MTs were MH40A, MH36, and QPM; the least-preferred were local varieties QPM and MH43A (Figure 2). MH40A and

MH36 were preferred for big kernels and ear size, good tip cover, and shiny grains. MH40A was also preferred for its nutritious trait. QPM was ranked among the most preferred varieties due to its nutritional value, despite it looking weevilled, its rotten cobs, and with dull grain. MH43A was among the least-preferred varieties for the MTs, despite being the second best for the farmers at Chisomo FFS where the evaluation was conducted.

Photo 1. Farmers assessing maize varieties (left) and counting and tallying of ribbons (right) at Chisomo FFS.

Figure 1. Maize varieties liked by farmers in selected FFS in 2020/21 season.

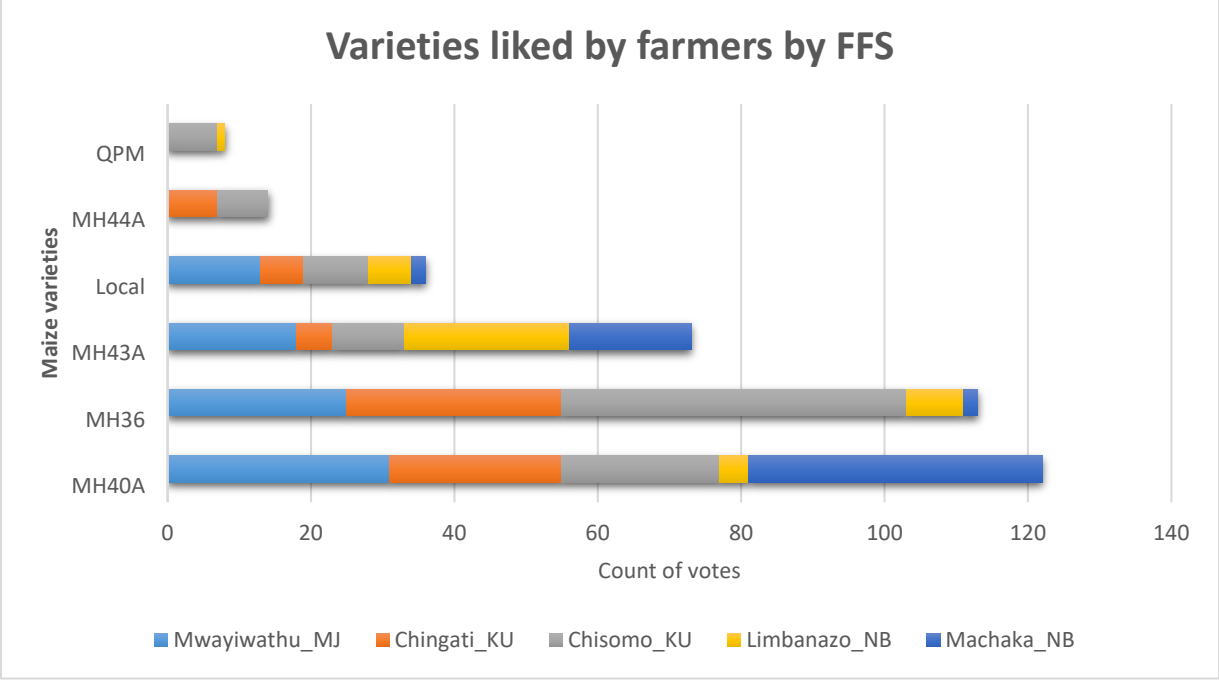
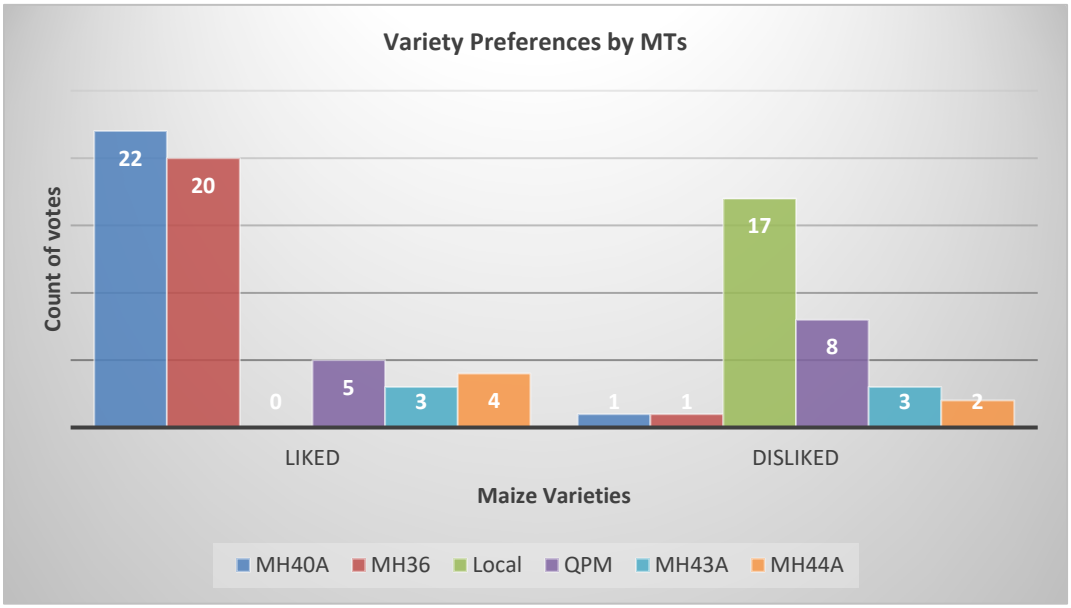


Figure 2. Maize variety preference trends among the MTs at Chisomo FFS in Kasungu.



- **IITA** carried out FPTEs on soybean, cowpea, and cassava (Photo 2). The results obtained indicated that 'Tikolore' was the preferred soybean variety, being ranked the best by 39.7% of the farmers in Thuchila, 67.9% in Lisasadzi, and 42.9% in Mzuzu for its early maturity and high pod yield (Annex 1). Farmers also preferred to use the improved production practice (i.e., certified seed, double-row planting, seed inoculation, and fertilizer application). Similarly, IT82E16 was the preferred cowpea variety; more than 80% of the farmers selected it for its early maturity and high pod yield; however, 72.9% of the farmers in Thuchila and 66.6% in Lisasadzi said that they would prefer growing the cowpea in sole stands for high pod yield (Annex 2). 'Mbundumali' was the most preferred cassava variety, with 67.8% of farmers in Thuchila, 62.6% in Lisasadzi, and 42.9% in Mzuzu selecting it for its good plant establishment, good plant vigor, suitability for leaf vegetable, and tolerance to termite damage (Annex 3).

Photo 2. Farmers assessing cassava (left) and soybean varieties (right) during an FPTE at Chisomo FFS, Lisasadzi, on 3 April 2021.

- **CIP** conducted FPTEs on potato at harvest (Photo 3). The results across the three RTCs revealed that farmers preferred 'Rosita' variety due to its high yield and good quality tubers.

Photo 3. FFS members for Tayambapo (left) and Limabanazo in Mzuzu (right) harvesting potatoes on 14 and 15 April 2021, respectively.


CIP conducted FPTEs for OFSP across the three RTCs and community outreach locations (Photo 4). Among the six OFSP varieties evaluated, 'Chipika' was the most preferred at Thuchira RTC and its community outreach locations. Farmers and MTs at Lisasadzi RTC strongly preferred the 'Mathuthu' variety due to its high root number, big root size, and high yield. In Mzuzu RTC, 'Royal Choice' was the most preferred variety for its smooth tuber, high root number, big root size, and overall root yield. Sensory evaluations were also conducted by having farmers taste boiled OFSP varieties and use three colored voting cards (*green = good taste, white = average, and pink = not good*). The results from Thuchila showed that FFS members from Mchikumbe and Tipindule-1 preferred the taste of non-fertilized 'Chipika' and fertilized 'Anaakwanire'. At Talandira and Tigwirizane FFS, most members preferred 'Kadyaubwerere', whereas members at Mwaiwathu FFS preferred 'Chipika'. In Lisasadzi, the overall results indicated that most men selected 'Zondeni' and women selected 'Mathuthu'. At Mzuzu RTC, combined results for Tata, Chilimbirano, and Lwanatonga indicated that most liked the taste of 'Royal Choice', whereas Machaka FFS members preferred 'Kadyaubwerere'. The findings from the OFSP technology evaluation provide clear information on how farmers' preference for the six OFSP varieties varies from one location to another as well as the criteria used for selection. The information is expected to provide direction to the future activities on variety promotion and recommendation within the target districts.

Photo 4. MTs in Kasungu (left) and members from Khomba FFS (right) during sweetpotato study plots harvesting on 10 May 2021.


- **ABC** conducted FPTEs for bean varieties that were exposed to two different treatments (inorganic fertilizer application and organic fertilizer application). At Thuchila RTC, both male and female farmers selected SER 124 as the first choice, followed by SAA 20 and NUA 45. At Lisasadzi RTC, both male and female farmers selected NUA 45 as the most-preferred variety, followed by SAA 20 and SER 124. Across nine outreach sites in Mzuzu RTC, NUA 45 was the most-preferred variety, followed by Napilira and SAA 20. Selection criteria differ by gender group and across locations. The ranking of the criteria was different for men and women, as well as for the different locations. However, some similarities in the selection criteria were observed between FFS in Mzuzu and FFS of Lisasadzi RTC. In all the locations, farmers used intricate combinations of traits for selecting common bean varieties; however, yield and resistance to diseases were cited as the most important traits in both gender groups and in all locations. Marketability, seed size, and seed color were perceived to be the most important selection criteria for men in all locations. Marketability was less important for women farmers in Kasungu and Nkhata Bay, whereas taste was ranked fourth. In general, women ranked the taste and cooking time as the top criteria for varietal choice, whereas men did not consider these traits to be important.
- **ICRISAT** organized FPTEs for groundnut varieties. The results obtained showed that farmers ranked CG 13 as the best variety, followed by CG 9 (Annex 4). That the local variety 'Chalimbana' was ranked last is not surprising, given the it did not offer the traits that farmers were looking for. Farmers wanted a variety that matures a bit early in the season, has large seed size, and is marketable. From the results of the FPTEs, earliness superseded all the traits used as shown by the fact that although CG 9's seed size is larger than CG 13's, this did not make CG 9 the top choice. This information is critical in that it gives direction for future breeding efforts to make sure that earliness should be accompanied by larger seed size. 'Chalimbana', on the other hand, was ranked last due to its late maturity, despite its having the largest seed size of the three varieties.

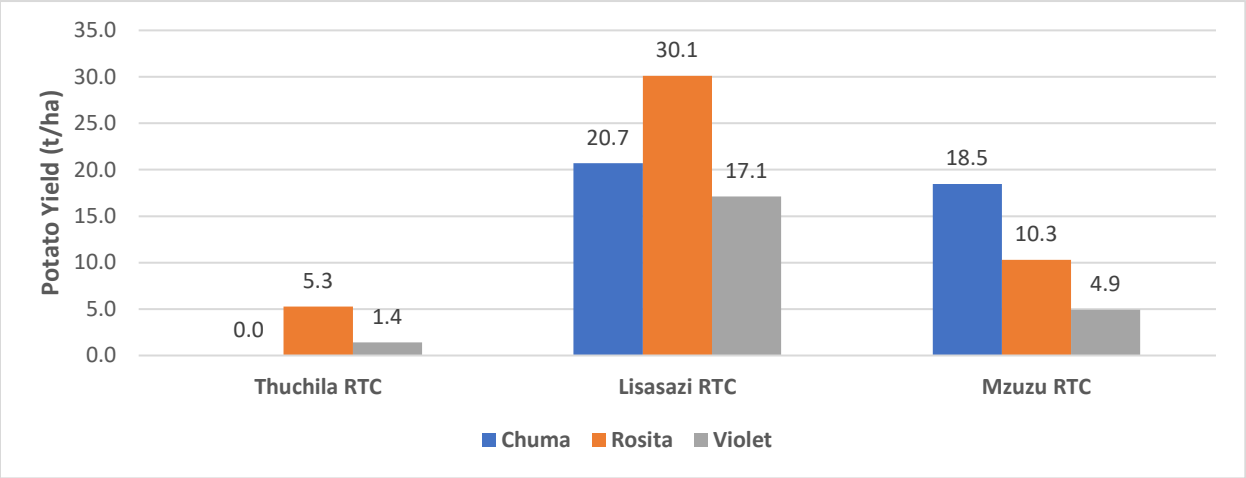
Sub-activity 1.3.1.3: Carry out participatory harvesting and yield assessment of the study plots

Participatory harvesting and yield assessment of study plots were also carried out across the three RTCs and their outreach stations, to monitor productivity increase due to the promoted technologies. Prior to the exercise, district agricultural crop SMS, MTs, CBFs, and FFS groups were trained and guided on the standard procedures for yield sampling in order to guarantee unbiased yield estimate and comparison between different treatments. The results obtained from the yield assessment by each CG center are presented below:

Yield performance from the potato-based technology study plot

- The results obtained from the potato-based technology study plot indicated that across the three RTCs, 'Rosita' was the best-performing variety, followed by 'Chuma' and 'Violet' (Figure 3, Annex 5). The highest yields for all three varieties were obtained from Lisasadzi RTC: 30.1 t/ha, 20.7 t/ha, and 17.1 t/ha for 'Rosita', 'Chuma', and 'Violet', respectively (Annex 6). In Mzuzu RTC, yield of 'Chuma' was the highest (18.5 t/ha), followed by 'Rosita' (10.3 t/ha) and 'Violet' (4.9 t/ha) (Annex 7). Thuchila RTC produced the lowest yields for 'Rosita' (5.3 t/ha) and 'Violet' (1.4 t/ha); no yields were reported for 'Chuma' (Figure 3).

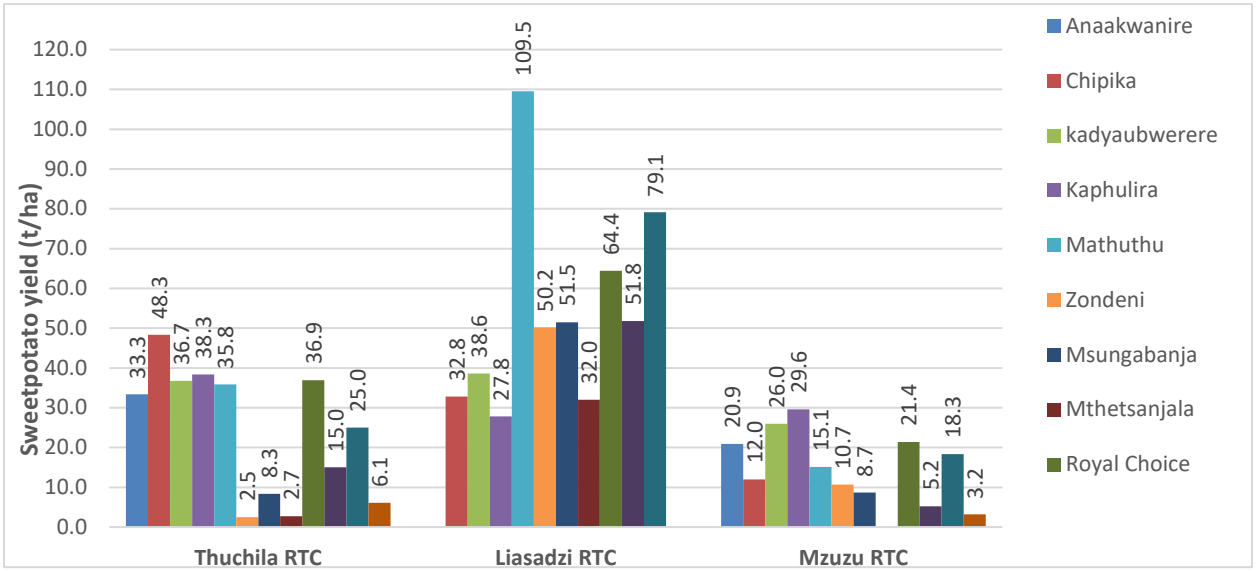
Figure 3. Yield of potato varieties harvested across the three RTCs.



Yield performance from the sweetpotato-based technology study plot

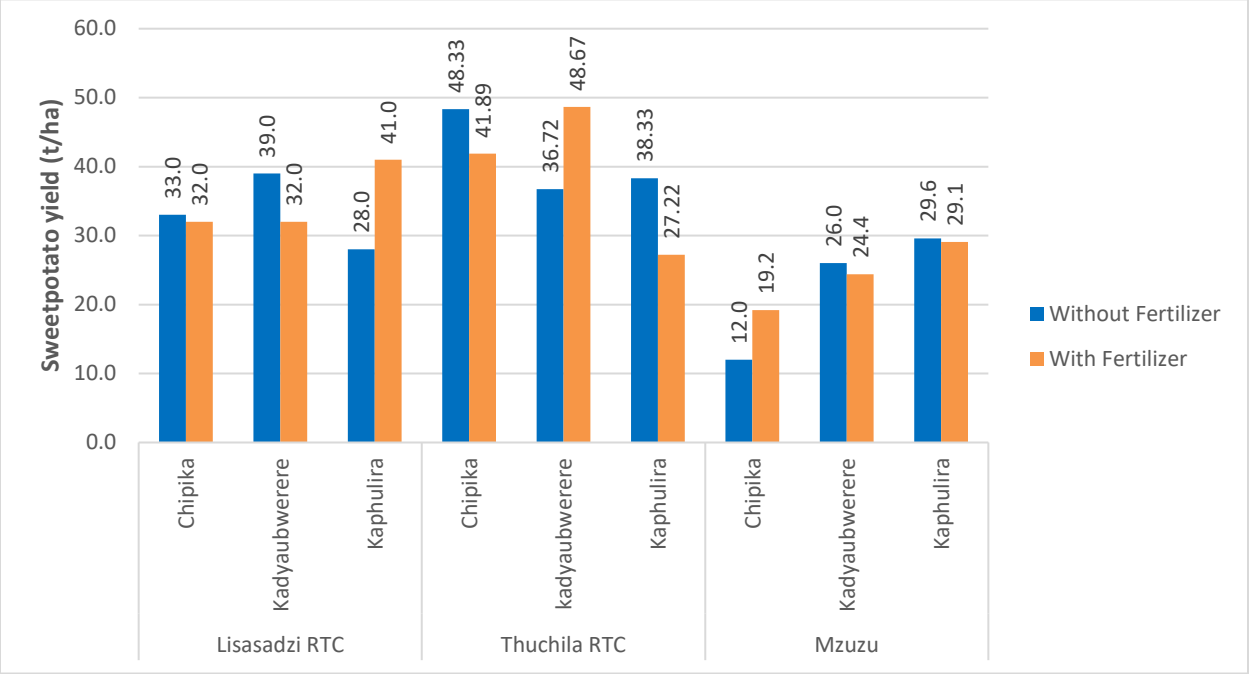
- The overall results obtained from the OFSP study plots indicated that Lisasadzi RTC obtained higher yields for almost all varieties, followed by Thuchila RTC (Figure 4). At Lisasadzi RTC, 'Mathuthu' variety showed the highest yield (109.0 t/ha), followed by 'Salera' (79 t/ha), a white-fleshed variety. At Thuchila RTC, 'Chipika' variety produced the highest yield (43.0 t/ha) and 'Zondeni' the lowest root yield (2.5 t/ha). At Mzuzu RTC, 'Kaphulira' variety produced the highest root yield (29.6 t/ha); the lowest root yield (3.3 t/ha) was obtained on the local variety. At the FFS sites, the results from Thuchila FFS locations showed that the highest yield of 23.0 t/ha was obtained from 'Kaphulira' variety, followed by 'Mathuthu' (22 t/ha) and 'Chipika' (21 t/ha). In Lisasadzi RTC FFS locations, 'Mthetsanjala' variety yielded the highest (24 t/ha), followed by 'Mathuthu' (21 t/ha). Results from Mzuzu FFSs revealed that 'Royal Choice' produced the highest root yield (18 t/ha), followed by 'Msungabanja' (16 t/ha).

Figure 4. Yields of different sweetpotato varieties harvested at Thuchila, Lisasadzi, and Mzuzu RTCs.



The effect of fertilizer application assessed on OFSP varieties revealed that varieties and locations responded differently to the fertilizer application. At Lisasadzi RTC, 'Chipika' and 'Kadyaubwerere' varieties responded negatively to fertilizer application. Meanwhile, 'Kaphulira' responded positively to fertilizer application: its yield was 41.0 t/ha compared with 28.0 t/ha without application of fertilizer (Figure 5). Similarly, at Thuchila RTC, 'Chipika' and 'Kaphulira' varieties responded negatively to fertilizer application. 'Kadyaubwerere' responded positively to fertilizer application (average yield of 48.7 t/ha) compared with a yield of 36.7 t/ha without fertilizer (Figure 5). The root yields obtained from Mzuzu RTC show that only 'Chipika' variety responded positively to fertilizer application (average root yield of 19.2 t/ha) compared with a yield of 12.0 t/ha without fertilizer. Fertilizer application had negative impact on 'Kadyaubwerere' and 'Kaphulira'. In most cases where fertilizer application improved the yield of OFSP at Lisasadzi RTC, the rate of yield improvement does not justify farmers' use of fertilizer. But farmers in Mulanje, especially Mchikumbe FFS, may consider using it as the yield for almost all varieties improved tremendously when fertilized. Generally, farmers will be able to attain higher yields of OFSPs by following recommended agronomic practices without using fertilizer.

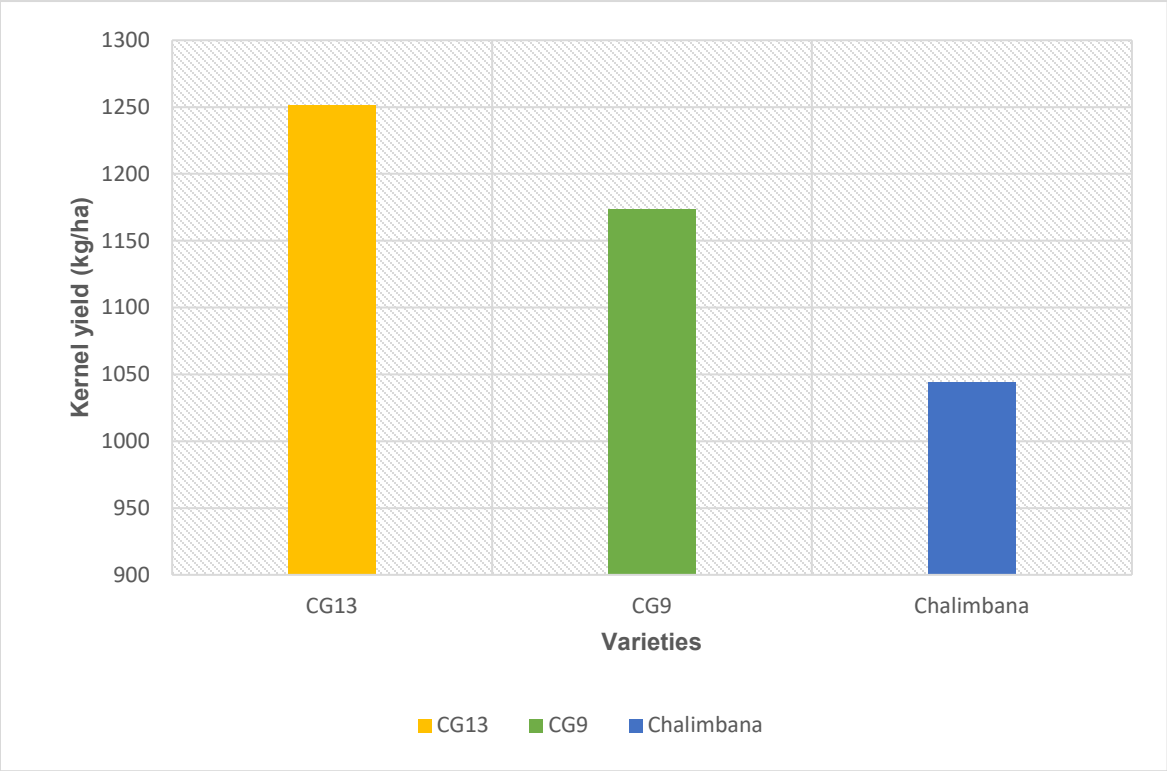
Figure 5. Yield comparison for three OFSP varieties planted with and without fertilizer at the three RTCs.



Yield performance from the groundnuts-based technology study plot

- Yield performance of groundnut varieties obtained at Lisasadzi RTC and selected outreach sites revealed that CG 13 had the highest yield of 1,251.0 kg/ha, followed by CG 9 (1,174 kg/ha), and a local variety 'Chalimbana' (1,044 kg/ha) (Figure 6). In Lisasadzi and Mzuzu RTCs, we compared the performance of newly released improved sorghum varieties Pilira 3 and Pilira 4 against older variety Pilira. The three improved varieties (Pilira 1, Pilira 2, and Pilira 3) were compared at Lisasadzi, and results show that Pilira 1 and Pilira 3 had similar yields, but Pilira 4 had higher yields. Similarly, the yield assessment of a doubled-up system of groundnut–pigeonpea (CG 9 with 'Mwaiwathualimi', CG 9 with 'Kachangu'; CG 13 with 'Mwaiwathualimi', and CG 13 with 'Kachangu') is currently ongoing. The results will be reported in the next quarter.

Figure 6. Yield of groundnut varieties across Lisasadzi RTC outreach sites in 2021.



Sub-activity 1.3.2: *Conduct further research on selected innovations/inputs and related technologies for VCs addressed within SO2 that are within the mandate of the CGIAR in Malawi.*

The following studies were carried out by WFC during the reporting period. The results will be reported in the next reporting period:

- A fish-stocking density experiment was carried out to assess the impact of stock density on the growth and performance of fish. In this study, 7,200 fingerlings of *Oreochromis shiranus* fingerlings were stocked at Tiyese FFS in Kasungu at Lisasadzi RTC. The ponds were stocked with eight fish/m^2, six fish/m^2, and three fish/m^2.
- Two ponds in Kavuzi section were also stocked with 7,200 fingerlings and comprised 3,600 *O. shiranus* and 3,600 *Coptodon rendalli*. The study was set up to compare different fish species in terms of production.
- Pond liming and pond fertilization with 1,250 kg of lime and 30 bags of chicken manure were applied to the ponds. The lime was applied at a basal application rate of 200 g/m^2 before filling up the ponds with water and two weeks before manure application. The objective for liming is to reduce the soil acidity and disinfect the pond from parasites and diseases like the epizootic ulcerative syndrome outbreak.

Sub-activity 1.3.3: *Document and disseminate lessons learned regarding the spreading and adaptation of innovations and technologies from CGs, including NRM/CCA practices, where applicable*

During the period under review, CGIAR attended the media event organized by GIZ at Kasungu RTC. The event aimed to increase the visibility of the project activities as well as the technologies being promoted through interaction with the media. CGIAR participated in this event through technology

displays as well as interacting with the media on the technologies being promoted. Similarly, CIP, in collaboration with the media team, organized a media tour from 14 to 20 March 2021. Members of different media houses were engaged in visiting CIP programs, including the KULIMA project activities at various districts. The media team had journalists from Malawi Broadcasting Corporation, Zodiak Broadcasting Station, Nation Publications Limited, The Times Group, and Malawi News Agency as national media platforms. Also participating were four community radio stations: Mzati (targeting Mulanje, Thyolo, Chiradzulu, and surrounding districts); Mzimba; Voice of Livingstonia (targeting Nkhata Bay and Mzimba districts); and Kasungu community radio. During the tour, the team was taken through the entire potato and sweetpotato VCs to appreciate the process. Later, potato and sweetpotato farmers were visited to share their experiences regarding the production of the two crops. The information captured by the media houses was aired over local TV and radio, as well as published in newspapers highlighting how various farmers have benefited from various programs. Similarly, a movie premier/documentary produced by GIZ-GIAE was launched by the honorable minister of agriculture and aired on Zodiak TV and Radio on 7 May 2021. The movie featured panel discussions on the contributions of GIZ/CGIAR to the KULIMA program, and how the technologies are transforming (or will transform) the livelihoods of smallholder farmers in the country in the wake of climate change.

Sub-activity 1.3.5: *Provide advisory service (as follow-up or on the application of provided innovations, including NRM/CCA practices) to (selected) producers and/or enterprises, based on demand and need (with a specific focus on women and young producers to level access to knowledge-based on a general assessment)*

During the reporting period, advisory services were provided to FFS groups across the three RTC on the application of Aflasafe to maize and groundnuts, its timing, and rate of application. A practical session on application of Aflasafe to maize and groundnuts was also carried out (Photo 5).

Photo 5. Training on Aflasafe application using a lecture presentation (left) at Chingati in Lisasadzi and a hands-on practical (right) at Talandira FFS in Thuchila, February/March 2021.

RA 2: Supply system of appropriate inputs and related technologies set up and meeting the needs to ensure increased, diversified, and sustainable production

Seed plays a crucial role in the transfer of improved crop varieties and fish breeds that are essential for increasing agricultural productivity and income generation in the context of climate change. The CG centers are working within KULIMA to strengthen the sustainable production and delivery system for quality seed, planting materials, and other productive inputs. KULIMA is also building demand among farmers for quality inputs of preferred varieties/breeds.

Main activity 2.1: Develop a sustainable system for production and distribution of quality planting material to producers in KULIMA

Sub-activity 2.1.1: *Develop an integrated concept on a sustainable system for production and distribution of quality seed and planting material to producers within KULIMA (including the VCs addressed within SO2)*

Earlier, CGIAR developed a concept for a sustainable supply system for production and distribution of quality seed and planting materials for producers and other inputs within KULIMA. In this concept, different VC commodities are grouped into five distinct seed systems: (1) cereals, (2) legumes, (3) root and tubers, (4) agroforestry trees, and (5) fish. The concept combined different strategies used by different CG centers to meet the increased demand for improved seed, planting materials, and other inputs by FFS groups. In this period, CGIAR continued to implement this integrated concept with the following achievements.

Sub-activity 2.1.2: *Ensure production of quality planting materials according to requirements, their dissemination to FFS (starter-kits at three RTCs and 15 selected outreach locations)*

Soybean seed production. IITA harvested 1.0 ha of 'Tikolore' soybean basic seed in Lisasadzi in April; 1,275 kg of seed was produced (Photo 6). Prior to seed storage, IITA conducted a germination test on the seed and results showed a 98.4% germination. (Minimum acceptable percentage by the Seed Certification Agency in Malawi is 98% for basic seed.) The seed will be distributed to selected community-based seed multipliers to produce certified seed in 2021–2022.

Photo 1. Harvesting, threshing, and bagging of basic seed of 'Tikolore' soybean variety.

Cowpea seed production. Cowpea seed was harvested in March/April; 9.3 kg of 'Mkanakaufiti', 39.8 kg of 'Sudan 1', and 44.9 kg of IT82E16 were realized. The results translate into respective yields of 140, 597, and 674 kg/ha. 'Mkanakaufiti' not only yielded the lowest, it also had the highest-grade outs (48.6%), unlike 'Sudan 1' (19.8%) and ITE82E16 (18.4%). Soybean and cowpea community-based seed multipliers were monitored and backstopped in the quarter. All the farmers had finished harvesting, even though few were still threshing and grading. These farmers were advised to finish the threshing and grading as soon as possible in readiness for sampling by the Seed Services Unit for testing. Those who had finished threshing were advised on postharvest handling of the seed (e.g., sorting, treating against weevil damage, packaging, and storing). In addition, the farmers, especially those who had paid the seed certification fees, were advised to refrain from selling the seed as grain to vendors.

Cassava stem production. Cassava is still in the field and will be harvested in November–December. Farmers were advised to build fences and firebreaks around the fields to guard against livestock and wildfires.

Common bean seed production. Similarly, ABC distributed 32 kg of NUA 45 basic seed to 14 seed multipliers to produce certified seed in summer.

In June yield data were collected from 12 of the 14 seed multipliers. The average yield was 475 kg/ha, with a maximum yield of 600 kg and a minimum yield of 90 kg—far below the variety's potential yield of 2,000 kg/ha. Low yield was attributed to both mid-season drought and some farmers not following recommended agronomic practices such as fertilizer application. In other locations, especially in Kasungu, the crop was heavily infested by pests and diseases. The farmers were advised to set aside part of the seed harvested to winter seed multiplication. During the period under review, ABC delivered seed for winter production (Table 2).

Table 2. Delivery of common bean basic seed for seed-to-seed multipliers for winter production

District	EPA	Quantity (kg)	No. of Farmers
Mulanje	Thuchila	160	5
Chitipa	Misuku	160	5

EPA = Extension Planning Area

Tree seedlings production. ICRAF, in collaboration with the NGO consortium led by Self Help Africa, trained 198 seed producers in agroforestry tree seed production in January 2021. The purpose of the training was to equip farmers with knowledge on seed production. The theoretical sessions were complemented with the field practical sessions/demos. These trainings were conducted before the imposition of more restrictive COVID-19 measures. During the training, 7,900 Gliricidia seedlings were distributed in Karonga to 74 farmers, and 36 kg of Tephrosia were distributed to 70 farmers in Karonga, Chitipa, and Mzimba districts.

Main activity 2.2: Develop the capacities of selected input and technology suppliers and producers in VCs addressed within SO1 and SO2

Following the identification of FFS and farmers to be engaged in seed production, ICRISAT and DARS distributed and used brochures to train producers in seed production. These farmers had previously been trained in seed production. The training through brochures was inevitable because of COVID-19.

Sub-activity 2.1.4: Provide assistance to MTs, CBFs, and selected community groups engaged in multiplication of planting materials

Potato seed. CIP provided Gibelellic acid to potato seed multipliers to help accelerate the sprouting process. In addition, Stella Chunga, a potato seed multiplier in Kasungu, was provided with treadle water pumps to facilitate irrigation of the seed.

Fish fingerlings production. The fish hatchery operator was visited for advisory services, given data sheets, and trained on recordkeeping, which will help him keep track of progress and achievements from the production figures. The hatchery operator was also oriented on other general aspects of seed production, including frequency and means of seed collection when using breeding ponds, fry-nursing techniques, and duration of the nursing period. Knowledge from the training should help him be successful as a producer of high-quality seed in the area.

The KULIMA phase 2 M&E progress, by results 1.1 and 1.2, is presented in Table 3.

Table 3. M&E progress summary

Indicators	Center	Gender		Total Progress to Date	Explanation
		M	F		
Result 1.1 Improved organization and delivery of national research and extension services					
No. of existing innovations selected for each AEZ of Malawi	ABC			3	Nutrient-dense common bean variety + improved management technologies (IMTs), common-based integrated soil fertility management technologies (mulching, soil, & water conservation structures)
	CIMMYT			2	Maize variety + IMTs and maize-based CA
	CIP			3	Sweetpotato variety+ IMTs, potato variety + IMTs, fertilizer blend for sweetpotato
	ICRAF			3	Gliricidia–maize intercrop, Tephrosia–maize intercrop, fruit trees
	ICRISAT			4	Groundnut variety + IMTs, pigeonpea varieties + IMTs, pigeonpea and groundnuts intercropping, sorghum + crop IMTs
	IITA			4	Cassava variety + IMTs, soybean + IMTs, cowpea + IMTs, Aflasafe + improved aflatoxin management technologies
	WFC			2	Integrate agri-aquaculture, fish culture, feed trials
	Total			**21**	
No. of integrated technology packages validated	ABC			1	Integrated soil fertility management and water conservation
	CIMMYT			1	CA (soil conservation, rotation, and legume intercropping)
	CIP			0	
	ICRAF			1	Tree-based farming systems
	ICRISAT			1	Integrated pest and disease management
	IITA			1	Aflasafe + improved aflatoxin management technologies
	WFC			1	Integrate agri-aquaculture
	Total			**6**	
No. of training modules with technical content (including study plot protocols) developed on technologies and integrated packages	ABC			1	Common bean production manual
	CIMMYT			1	A compilation of eight brochures on CA and maize varieties
	CIP			2	2 potato production training manuals and a sweetpotato production training manual, for both seed and ware
	ICRAF			1	Agroforestry modules training manual
	ICRISAT			1	Training guide for groundnut, pigeonpea, sorghum, and finger millet in Malawi
	IITA			4	Growing soybean in Malawi; Growing cowpea in Malawi; Cassava-growing training manual; and Aflatoxin control using Aflasafe (with 360 copies)
	WFC			1	Fish farmers training guide; pond aquaculture
	Total			**11**	
No. of MTs trained by technology or technology package	CIAT	21	6	27	
	CIP	48	12	60	
	IITA	41	12	53	
	ICRISAT				
	CIMMYT	59	19	78	
	ICRAF	52	18	70	26 (19 men, 7 women) in Lisasadzi, 30 (23 men, 7 women) in Thuchila, and 14 (10 men, and 4 women) in Mzuzu
	WFC	13	20	33	
	Total	**221**	**67**	**321**	

Indicators	Center	Gender		Total Progress to Date	Explanation
		M	F		
No. of study plots established at 3 RTCs for technologies and technology packages	ABC			9	3 study plots at each RTC
	CIMMYT			0	None this quarter
	CIP			0	None this quarter
	ICRAF			0	None this quarter
	ICRISAT			0	None this quarter
	IITA			0	None this quarter
	Total	**0**	**0**	**0**	
No. of study plots established at outreach locations for technologies and technology packages	CIAT			0	None this quarter
	CIMMYT			0	None this quarter
	CIP			0	None this quarter
	ICRAF			0	None this quarter
	ICRISAT			0	None this quarter
	IITA			0	None this quarter
	WFC			0	None this quarter
	Total			**0**	
No. of starter kits provided to sites where MTs train CBFs	Third cohort 2020			95	Starter kit report
	Total			**95**	
No. of FPTEs conducted	ABC			20	
	CIMMYT			6	1 with MTs in Lisasadzi and 5 with COGs (1 in Thuchila, 2 in Mzuzu, and 2 in Lisasadzi)
	CIP			3	
	ICRAF			0	Reported in the previous quarter
	ICRISAT			4	
	IITA			23	10 on soybeans, 6 on cowpeas, and 7 on cassava
	WFC			5	WFC report Lusangazi and Kavuzi COGs. Participatory growth monitoring and integrated technologies
	Total			**55**	
No. of farmers participating in technology evaluations	ABC	65	133	198	ABC Report
	CIMMYT	34	94	128	CIMMYT Report
	CIP	126	325	451	
	ICRAF	0	0	0	Reported last quarter from report
	ICRISAT	23	59	82	Not available
	IITA	76	123	199	IITA Report
	WFC	20	40	60	WFC report: Lusangazi 38 (16 men, 22 women), Kavuzi 22 (18 women, 4 men)
	Total	**344**	**774**	**1,118**	
No. of adapted technologies and technology packages described based on FPTEs	ALL			5	Center technology package

Indicators	Center	Gender		Total Progress to Date	Explanation
		M	F		
Result 1.2: supply system of appropriate inputs and related technologies set up and meeting the needs to ensure increased, diversified, and sustainable production					
No. of concepts on a sustainable system for production and distribution of quality seed and planting material for producers within KULIMA	ALL			3	Center technology package
No. of partners involved in development of concept and implementation of the seed system	ALL			6	Center technology package
No. of multipliers trained in production of quality seed/ planting material/seed	ABC			0	
	CIMMYT			0	
	CIP			0	
	ICRAF			0	
	ICRISAT			0	
	IITA			0	
	WFC			17	
	Total			**17**	
No. of multipliers provided with start-up materials and producing quality seed/planting material	ABC	6	6	12	ABC report annex 6 males and 6 females
	CIMMYT			0	
	CIP			0	
	ICRAF			0	
	ICRISAT			0	
	IITA			44	16 on soybean, 9 on cowpea, and 18 on cassava
	WFC			0	
	Total			**56**	
No. of inputs/ technologies covered in training package for agro-dealers	ABC				Not in this reporting period
	CIMMYT				
	CIP				
	ICRAF				
	ICRISAT				
	IITA				
	WFC				
	Total				
No. of agro-dealers trained in inputs/ technology supply	None				Not in this period

2. Management Issues

The CGIAR project component, managed by GIZ, consists of seven CG centers embedded in a wider program of complex and interdependent partnerships. Participating are the FAO, a consortium of NGOs, and different GoM departments. Naturally, implementing such an initiative requires intensive management, partnership development, communication, and coordination beyond simply implementing work plan activities.

This section highlights some of the management issues undertaking during the reporting period.

2.1 Coordination and visibility activities

Other coordination and key activities underten during this period include:

- Series of virtual coordination meetings were held with GIZ, FAO, and the NGO consortium to enhance collaboration and coordination among different implementing partners.
- CG centers attended a virtual meeting convened by GIZ-GIAE on 11 February to discuss agro-dealer and seed multiplication activities for 2021.
- Virtual project technical meeting was organized on 28 May 2021 to review progress, identify challenges, and reflect on the lessons learned to enhance the impacts of the project intervention.
- CGIAR attended virtual external ROM review meeting on 18 June 2021. The meeting aimed at clarifying some of the emerging issues that ensued during the field visit of the ROM expert.

2.2 Management issues and challenges raised by CGIAR partners

- Waves of COVID-19 infections continue to pose project implementation challenges. However, project activities were implemented with adherence to the regulations imposed by GoM, donors, and ICRAF's office.
- Impassable roads due to too heavy rains, especially in Mzuzu, made it impossible to reach some FFS for FPTEs, greatly reducing participation. The poor road conditions also affected backstopping of the community seed multipliers as some sites, especially in Nkhata Bay and Nkhotakota, could not be reached.
- COVID-19 continued to affect project activities, mostly the FPTEs. Because of the pandemic, the number of farmers participating in these evaluations at any site had to be restricted in order to comply with the COVID-19 preventive guidelines.

3. Planned Activities for the Next 6 Months

Table 4 shows the project activities planned for the next six months (July–December 2021).

Table 4. Planned activities for the next six months

Activity Work Plan			July				August				September					October				November				December			
Center		ACTIVITY	1	2	3	4	1	2	3	4		1	2	3	4	1	2	3	4	1	2	3	4				
CIP																												
	A. COORDINATION																											
	A1	Prepare work plan of activity for six month no-cost extension (NCE)																										
	A2	Prepare a proposal for NCE																										
	A3	Organize technology result dissemination and seed systems workshops																										
	A4	Participate in PTC and district ADD/GIZ planning meetings																										
	A5	Review curriculum for training of 4th cohort of MTs																										
	B. TECHNICAL ASSIGNMENTS																											
	B1	Identify and train new seed/vine multipliers																										
	B2	Winter seed production of potato and sweetpotato to produce potato seed and vines for the establishment of study plots																										
	B3	Select site and plot demarcation at RTCs and various FFS outreach locations for the establishment of study plots																										
	B4	Procure seed and other inputs for the establishment of study plots																										
	B5	Procure and organize the deliveries of starter kits to graduated MTs for the establishment of study plots																										
	B6	Technical briefing of MTs on study plot protocols across the 3 RTCs																										
	B7	Establish study plots across the 3 RTCs and the selected outreach locations																										
	B8	Train agro-dealers across project intervention districts																										
ABC																												
	B. TECHNICAL ASSIGNMENTS AND REPORTING																											
	B1	Finalize report on bean certified seed yield assessment from seed multipliers																										
	B2	Conduct seed business and seed production trainings for seed multipliers																										
	B3	Produce a brochure on descriptors of bean varieties promoted under the KULIMA project																										
	B4	Produce a brochure on integrated soil fertility management and soil water conservation technologies promoted under the KULIMA project																										
	B5	Site selection and plot demarcation at RTCs and various FFS outreach locations for the establishment of study plots																										

	B6	Procurement of seed and other inputs for study plots																										
	B7	Attend technology result dissemination workshop																										
	B8	Identify and train new seed multipliers																										
CIMMYT																												
	B. TECHNICAL ASSIGNMENTS AND REPORTING																											
	B1	Monitor winter study plots in collaboration with the NGO consortium																										
	B2	Participate in technology result dissemination and seed systems workshop																										
	B3	Train agro-dealers across project intervention districts																										
	B4	Contribute to preparation of starter kits for the graduate MTs																										
	B5	Select sites and plot demarcation at new FFSs																										
	B6	Protocol training sessions for 4th cohort MTs																										
	B7	Procure study plots for the 2021–2022 season study plots																										
	B8	Establish study plots in all RTCs and selected outreach sites																										
ICRISAT																												
	B. TECHNICAL ASSIGNMENTS AND REPORTING																											
	B1	Facilitate seed sampling for laboratory certification																										
	B2	Review curriculum for training of 4th cohort																										
	B3	Procure inputs and packaging according to types of study plots																										
	B4	Prepare and package seed																										
	B5	Verify and prepare land																										
	B6	Deliver inputs for the establishment of study plots																										
	B7	Facilitate planting of study plots at the 3 RTCs and outreach sites																										
IITA																												
	C.TECHNICAL ASSIGNMENTS AND REPORTING																											
	B1	Aflatoxin analysis of 2021 maize and groundnut grain samples from study plots																										
	B2	Review curriculum for IITA technology (soybean, cowpea, cassava, and Aflasafe/Aflatoxins management) study plots																										
	B3	Protocol briefing of MTs on establishment of study plots																										
	B4	Procure and/or deliver inputs (seeds, fertilizers, pegs, packaging materials, etc.) and starter kits to outreach sites																										

	B5	Select sites for study plots (RTCs and outreach) and early generation seed multiplication																									
	B6	Support MTs and outreach groups in land preparations, plot ,demarcation and establishment of the study plots (RTCs and outreach sites)																									
	B7	Facilitate land preparation, plot demarcation and establishment of early generation seed at Lisasadzi																									
	B8	Conduct FPTEs (for cassava at harvest)																									
	B9	Identify, select, and register seed multipliers/farms																									
	B10	Train registered seed/stem multipliers in quality seed production, including rapid multiplication (cassava), and record keeping, include subjects on certified, QDS/planting material																									
	B11	Procure and deliver parent seed and other inputs to the selected multipliers																									
	B12	Attend seminars and meetings, including ADD/GIZ planning meetings, as required																									
ICRAF																											
	B. TECHNICAL ASSIGNMENTS AND REPORTING																										
	B1	Assess agroforestry tree performance after crop harvest																									
	B2	Provide training on participatory technology appraisals on timely incorporation of leaves biomass into the soil																									
	B3	Farmers' technical briefing on the management of individual tree seed bank																									
	B4	Procure inputs and establish study plots at RTC and 30 outreach locations																									
	B5	Establish study plots at 3 RTCs																									
	B6	Training groups/individual seed multipliers on tree seed production																									
	B7	Distribute startup kits for seed producers																									
WFC																											
	TECHNICAL ASSIGNMENTS AND REPORTING																										
	B1	Monthly participatory sampling and monitoring of fish growth at Thuchila and Tiyese fishpond																									
	B2	Establish hatchery and procure materials																									

Appendix A. Status of MT training manuals cleared by respective CG headquarters

CG Center	Training Materials	Cleared	Not Cleared
CIP	Potato Production Manual	√	
	Sweetpotato Production Manual	√	
CIAT	Common Bean Production Manual	√	
	Integrated Soil Fertility Management and Soil and Water Conservation	√	
CIMMYT	Implementing Conservation Agriculture on Farmers' Fields	√	
	Manual Seeding Systems in Conservation Agriculture	√	
	Conservation Agriculture—The Importance of Crop Rotations	√	
	Cereal and Legume Intercropping in Smallholder Conservation Agriculture Systems	√	
	Conservation Agriculture—The Role and Importance of Residues	√	
	Conservation Agriculture —A Sustainable System	√	
	Weed Control in Smallholder Conservation Agriculture	√	
	Dt-Nutrient Dense Maize Variety Guide	√	
ICRAF	Agroforestry Modules Training Manual		
ICRISAT	Guide for Groundnut, Pigeon Pea, Sorghum, and Finger Millet Production in Malawi	√	
IITA	Aflatoxin Management in Maize and Groundnuts using Aflasafe	√	
	Cassava Growing Training Manual	√	
	Growing Cowpea in Malawi	√	
	Growing Soybean in Malawi	√	
WFC	Fish Farming Trainers Guide—Pond Aquaculture	√	

Annexes

Annex 1. Farmers' preference for soybean varieties at vegetative stage in Thuchila, Lisasadzi, and Mzuzu in 2021

	Varietal Preference (%)			Trait Preference (%)								
				Earliness to Maturity			Pod Load/Yield			Pod Size		
RTC/FFS	M	F	Total	M	F	Mean	M	F	Mean	M	F	Mean
Thuchila (n=97: 33 males, 64 females)												
Tikolore	41.7	37.7	39.7	100.0	89.1	94.6	33.3	21.9	27.6	0.0	0.0	0.0
Makwacha	37.5	29.8	33.6	0.0	7.8	3.9	30.3	25.0	27.7	37.5	32.8	35.2
Nasoko	0.0	3.9	2	0.0	0.0	0.0	9.1	9.4	9.3	56.3	56.3	56.3
Local	20.8	28.5	24.7	0.0	3.1	1.6	27.3	43.8	35.6	6.3	10.9	8.6
Lisasadzi (n=88: 40 males, 48 females)												
Tikolore	56.1	76.3	67.5	100.0	100.0	100.0	44.1	61.1	52.6	17.2	13.7	15.5
Makwacha	25.7	3.0	10.8	0.0	0.0	0.0	37.5	15.1	26.3	31.1	41.0	36.1
Nasoko	14.9	17.9	18.6	0.0	0.0	1.8	13.2	9.9	11.6	47.7	31.3	39.5
Local	3.3	2.9	3.1	0.0	0.0	0.0	5.3	13.9	9.6	4.0	14.0	9.0
Mzuzu (n=9: 2 males, 7 females)												
Tikolore	0	85.7	42.9	100.0	100.0	100.0	33.3	81.8	57.6	33.3	0.0	16.7
Makwacha	50	14.3	32.1	0.0	0.0	0.0	33.3	18.2	25.8	33.3	90.9	62.1
Nasoko	50	0	25	0.0	0.0	0.0	0.0	0.0	0.0	33.3	9.1	21.2
Local	0	0	0	0.0	0.0	0.0	33.3	0.0	16.7	0.0	0.0	0.0
Overall (n=194: 75 males, 119 females)												
Tikolore	32.6	66.6	50.0 (1)	100.0	96.4	98.2	36.9	54.9	45.9	16.8	4.6	10.7
Makwacha	37.7	15.7	25.5 (2)	0.0	2.6	1.3	33.7	19.4	26.6	34.0	54.9	44.4
Nasoko	21.6	7.3	15.2 (3)	0.0	0.0	0.6	7.4	6.4	6.9	45.8	32.2	39.0
Local	8.1	10.5	9.3 (4)	0.0	1.0	0.5	22.0	19.2	20.6	3.4	8.3	5.9

Annex 2. Farmers' preference for cowpea varieties at vegetative stage in Thuchila, Lisasadzi, and Mzuzu in 2021

RTC/FFS	Varietal Preference (%)			Trait Preference (%)								
				Earliness To Maturity			Pod Yield			Pod Size		
	M	F	Total	M	F	Mean	M	F	Mean	M	F	Mean
Thuchila (n=45: 16 males, 29 females)												
IT82E16 +Maize	33.3	25.0	29.2	10.0	20.0	15.0	41.7	25.0	33.3	41.7	29.2	35.4
Sudan 1 + Mz	0.0	2.1	1.1	0.0	0.0	0.0	5.0	2.1	3.6	38.4	58.4	48.4
Mkanakaufiti + Mz	0.0	0.0	0.0	10.0	0.0	5.0	5.0	0.0	2.5	0.0	4.2	2.1
IT82E16 (Sole)	66.7	72.9	69.8	80.0	80.0	80.0	48.4	72.9	60.6	20.0	8.9	14.4
Lisasadzi (n=70: 35 males, 35 females)												
IT82E16 +Maize	5.6	0.0	2.8	0.0	0.0	0.0	2.5	3.6	3.0	19.5	15.7	17.6
Sudan 1 + Mz	11.5	12.5	12.0	38.4	17.5	27.9	2.8	7.8	5.3	36.9	41.1	39.0
Mkanakaufiti + Mz	5.6	3.6	4.6	8.3	25.0	16.7	2.8	0.0	1.4	2.5	10.0	6.3
IT82E16 (Sole)	77.4	83.9	80.6	53.3	57.5	55.4	92.0	88.7	90.3	41.1	33.2	37.2
Overall (n=115: 45 males, 70 females)												
IT82E16 +Maize	19.4	12.5	16.0 (2)	5.0	10.0	7.5	22.1	14.3	18.2	30.6	22.4	26.5
Sudan 1 + Mz	5.7	7.3	6.5 (3)	19.2	8.8	14.0	3.9	4.9	4.4	37.6	49.7	43.7
Mkanakaufiti + Mz	2.8	1.8	2.3 (4)	9.2	12.5	10.8	3.9	0.0	1.9	1.3	7.1	4.2
IT82E16 (Sole)	72.0	78.4	75.2 (1)	66.7	68.8	67.7	70.2	80.8	75.5	30.6	21.0	25.8

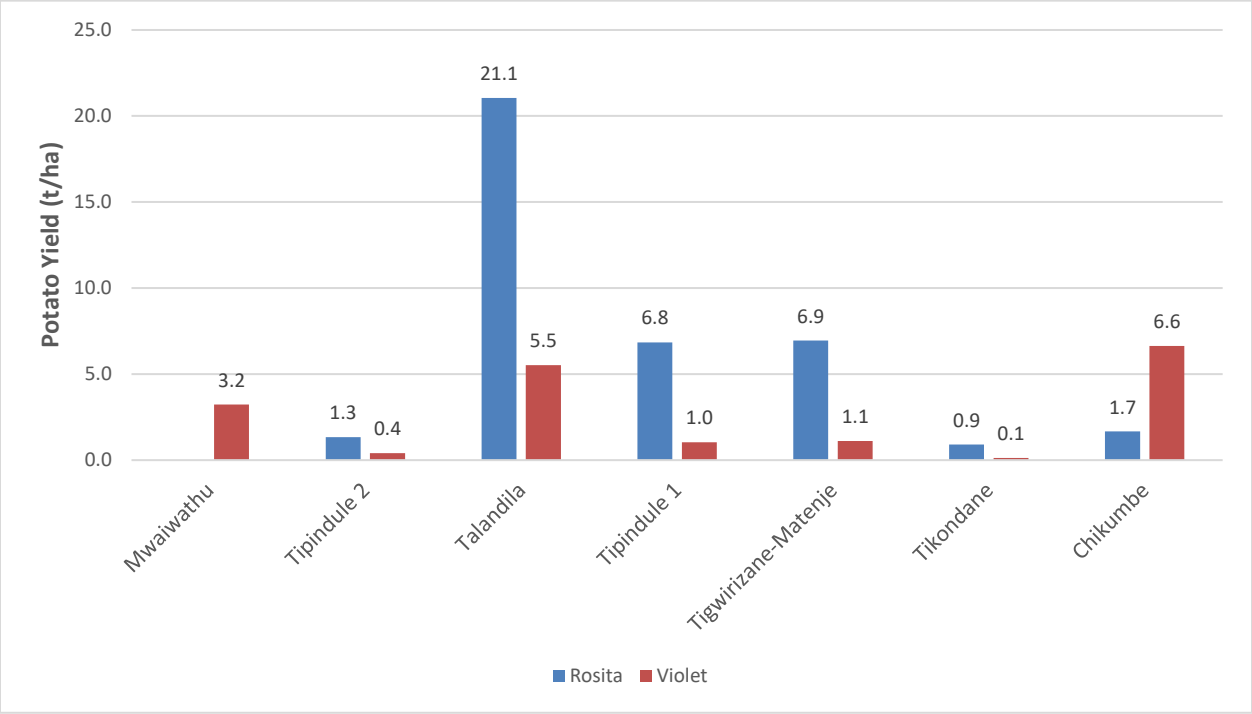
Annex 3. Farmers' preference for cassava varieties at vegetative stage in Thuchila, Lisasadzi, and Mzuzu

Variety	Thuchila (Overall)			Plant Establishment			Plant Vigor			Suitability for Vegetable		
	M	F	Total	M	F	Mean	M	F	Mean	M	F	Mean
Thuchila (n=55: 12 males, 43 females)												
Mpale	8.4	5.3	6.8	0.0	2.7	1.3	16.7	11.5	14.1	8.4	0.0	4.2
Sauti	0.0	0.0	0.0	8.4	9.4	8.9	8.4	13.2	10.8	16.7	8.9	12.8
Sagonja	16.7	34.0	25.4	33.3	58.6	45.9	66.7	51.8	59.2	41.7	18.8	30.2
Mbundumali	75.0	60.8	67.8	58.4	29.4	43.9	8.4	23.6	16.0	33.4	72.4	52.9
Lisasadzi (n=73: 29 males, 44 females)												
Mpale	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.8	0.9	0.0	5.4	2.7
Sauti	0.0	0.0	0.0	0.0	0.0	0.0	10.0	15.3	12.6	5.0	3.6	4.3
Sagonja	39.4	35.3	37.3	55.1	27.8	41.5	49.2	52.4	50.8	21.7	22.0	21.9
Mbundumali	60.6	64.7	62.7	44.9	72.6	58.8	40.8	30.6	35.7	73.3	69.1	71.2
Mzuzu (n=9: 2 males, 7 females)												
Mpale	50.0	14.3	32.1	0.0	0.0	0.0	50.0	0.0	25.0	50.0	14.3	32.2
Sauti	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sagonja	50.0	0.0	25.0	0.0	0.0	0.0	50.0	14.3	32.2	0.0	0.0	0.0
Mbundumali	0.0	85.7	42.9	####	100.0	100.0	0.0	85.7	42.9	50.0	85.7	67.9
Overall (n=137: 43 males, 94 females)												
Mpale	19.5	6.5	13.0 (3)	0.0	0.9	0.4	22.2	4.4	13.3	19.5	6.6	13.0
Sauti	0.0	0.0	0.0 (4)	2.8	3.1	3.0	6.1	9.5	7.8	7.2	4.2	5.7
Sagonja	35.4	23.1	29.2 (2)	29.5	28.8	29.1	55.3	39.5	47.4	21.1	13.6	17.4
Mbundumali	45.2	70.4	57.8 (1)	67.8	67.3	67.6	16.4	46.6	31.5	52.2	75.7	64.0

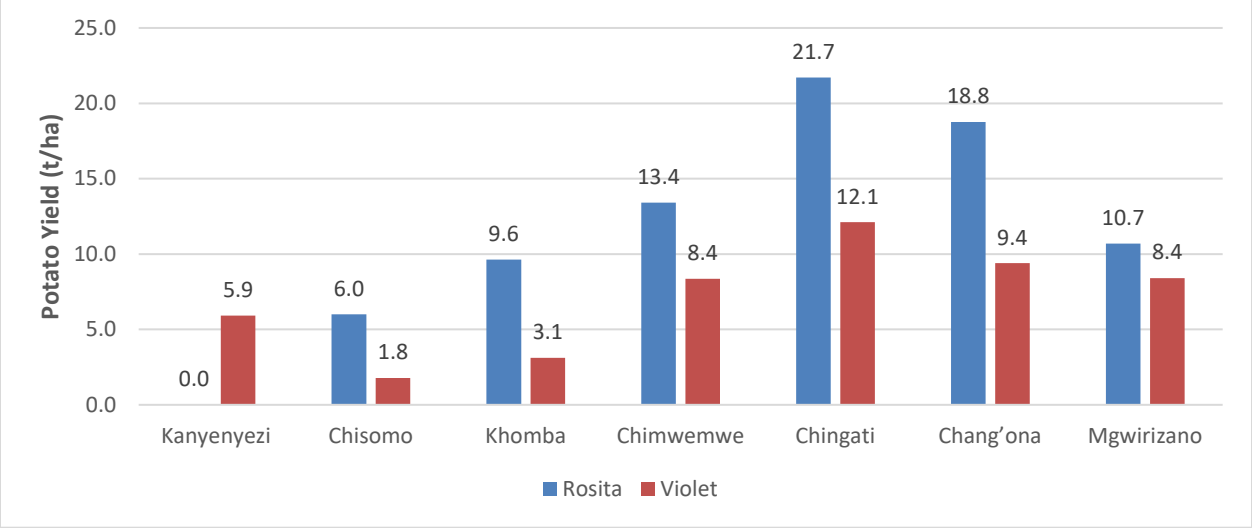
Annex 4. Farmers' participatory ranking of groundnuts varieties

	Varieties		
FFS	**CG 9**	**CG 13**	**Chalimbana (Local)**
Khomba	18	38	0
Kanyenyezi	24	7	0
Chingati	11	13	6
Limbanazo	5	27	6
Machaka	31	36	20
Total	**89**	**121**	**32**
Overall Rank	2	1	3

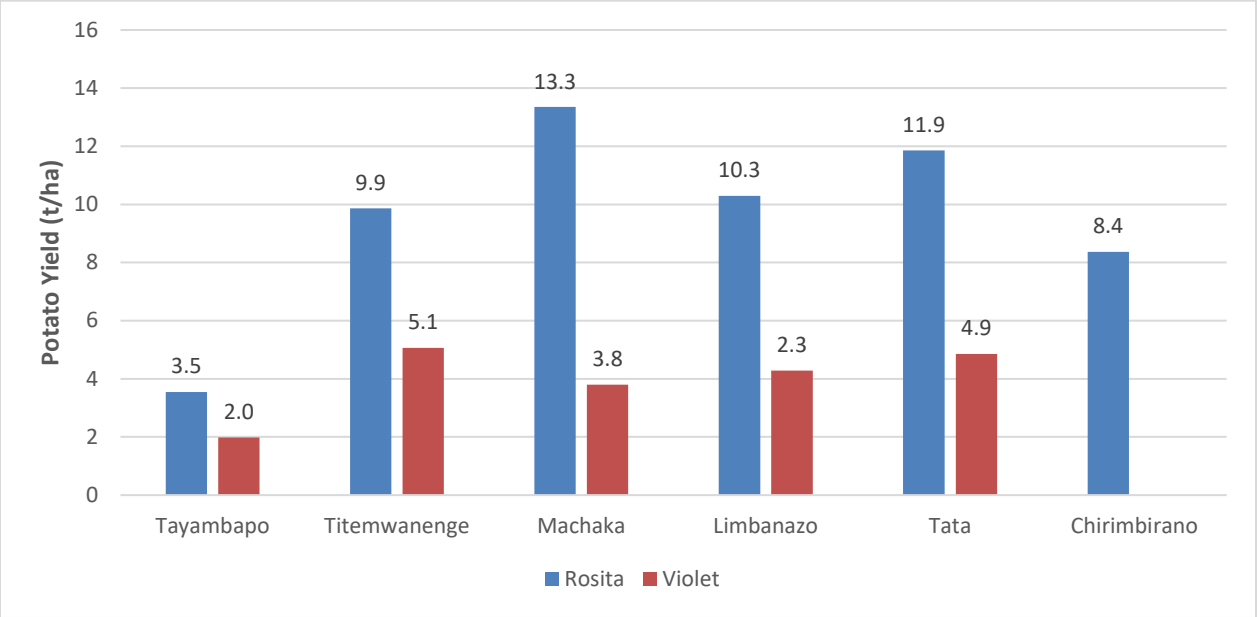
Annex 5. Yield of potato varieties harvested at FFS in Thuchila-Mulanje



Annex 6. Yield of potato varieties harvested at FFS in Lisasadzi RTC-Kasungu



Annex 7. Yield of potato varieties harvested at FFS locations in Nkhata Bay-Mzuzu RTC



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