CCARDESA

Centre for Coordination of Agricultural Research and Development for Southern Africa

SADC – Southern African Development Community – Towards a Common Future

AGRICULTURAL PRODUCTIVITY PROGRAMME FOR SOUTHERN AFRICA (APPSA)

Compendium of Agricultural Productivity Programme for Southern Africa (APPSA) technologies generated and disseminated in Malawi, Mozambique and Zambia

Government of Malawi

Government of Mozambique

Government of Zambia

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SELECTED TECHNOLOGIES GENERATED/DISSEMINATED BY THE AGRICULTURAL PRODUCTIVITY PROGRAMME FOR SOUTHERN AFRICA (APPSA)

Figure 1: Summary of some of the technologies generated and disseminated by APPSA

Figure 2: Number of technologies generated and taken from the shelf

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Foreword

The Agricultural Productivity Programme for Southern Africa (APPSA) was a World Bank funded project which was coordinated by CCARDESA during its implementation in Malawi, Mozambique and Zambia. APPSA was predicated on the fact that National Agricultural Research Systems (NARS) in Africa were often challenged by complex agricultural production systems, low levels of financing spread over many priorities, limited access to improved technologies, human resource constraints, poor quality of infrastructure, weak technology dissemination systems and barriers to transnational technology spillovers. Coordination efforts by CCARDESA were aimed at strengthening and scaling up regional cooperation in generation of technologies, capacity building, and knowledge sharing in commodities prioritised by the APPSA implementing countries. Under APPSA, each country established a Regional Center of Leadership on a commodity of national as well as regional importance, thereby allowing regional specialization around priority farming systems. Malawi elected to take regional leadership in research and development efforts under maize-based cropping systems, while Mozambique elected to take leadership in rice-based cropping systems. Zambia took leadership in research and development efforts under food legume-based cropping systems (beans, cowpeas, groundnuts, pigeon peas, and soybeans).

It was the expectation of the project that outputs from the three RCoLs would be shared across the SADC region. APPSA has successfully generated several technologies, innovations, and management practices (TIMPs) that have been shared within the participating countries and across the SADC region. APPSA supported the dissemination of improved technologies by providing resources for RCoLs to engage with a range of partners in scaling up the use of promising innovations of relevance to the targeted commodities.

In this compendium, the authors present selected technologies which were generated and/or disseminated by APPSA. These technologies continue to play a big role in revolutionizing agricultural production and productivity in the SADC region. Stakeholders are encouraged to continue disseminating the technologies amongst smallholder farmers and other end-users to ensure wide adoption. The target users of each technology, challenges encountered during the generation and dissemination of the technologies, proposed solutions and recommendations are presented for the purposes of assisting the stakeholders in designing and implementing effective dissemination strategies.

Executive Summary

This compendium presents the first volume of selected technologies that were generated and/or disseminated by Agricultural Productivity Programme for Southern Africa (APPSA). These technologies include those that were generation by the programme and those that were taken from the shelf. The aim of APPSA was to strengthen and scale up regional cooperation in generation of technologies, capacity building, and knowledge sharing in legumes, rice and maize farming systems. For the life of the project, 74 R&D subprojects were implemented. Five sub-projects focussed on cassava, eight on climate smart agriculture, 28 on legumes, 21 on maize, 10 on rice and two on sorghum. During the 6 years of implementation APPSA generated a total of 160 technologies, innovations and management practices (TIMPs), while 301 TIMPs were disseminated to farmers. Most of the disseminated technologies were already on the shelf when APPSA commenced in 2013. Sixty-eight (68) TIMPs were shared across the three countries. Some of the dissemination pathways used included lead farmers, demonstrations, on-farm field days, agriculture shows, seed fairs, print media, electronic media, innovation platforms, and IEC materials. The project reached a total of 4.61 million beneficiaries drawn from Malawi, Mozambique and Zambia, of which 42 percent were females and 41300 were lead farmers. In addition, APPSA trained a total of 97,700 smallholder farmers on good agricultural practices.

The key TIMPs reported in this volume are in areas of nutrition (vitamin A maize and nutritional products from soybean processing), human health/food safety (aflatoxin management in groundnuts), mitigating the effects of climate variability (drought tolerant maize and cowpeas, and short season legumes and rice), soil/water management (soil fertility, conservation agriculture (CA) technologies), promoting “new” cash crops (beans, soybean, pigeon pea, rice), post-harvest storage (small scale metal silo testing/fabrication, R&D on storage pests), labour saving technologies and resistance to pests and diseases. A total of 121 TIMPs are reported in this volume, the majority being maize-based (26) and bean-based (21) technologies while sorghum (2 technologies) has the least (Figure 1). Most of the maize varieties that were disseminated combined the traits of vit A, drought tolerances and low nitrogen (7), while six were resistant to striga. Close to 50% of the bean-based technologies targeted market classes implying that technology generation and dissemination activities were oriented towards income generation. Technology generation and dissemination also targeted bruchids which are amongst the most important storage pests of beans. Nine of the 10 cowpea varieties that were disseminated had drought and low nitrogen tolerance traits. Most groundnut varieties reported in this compendium contain high oil content, which was a response to the requirements in the confectionery industry. The project also facilitated the generation and dissemination of labour saving technologies and this compendium reports two categories of labour saving technologies thus conservation agriculture (8%) and processing of produce (4%). Finally, the compendium also reports soil fertility management technologies which comprise 6% of the 121 compiled technologies. Sixty-five technologies presented in this volume were generated by APPSA while the other 56 were taken from the shelf and validated and disseminated (Figure 2).

Apart from the generation and dissemination of the technologies, the project also facilitated the trainings, strengthened seed systems, facilitated the establishment of regional collaboration & R&D management structures & systems and enhanced the quality of science through peer reviews. APPSA. Information on the improved technologies, innovations, and management practices was made available online through the SAAIKS Knowledge Hub which is accessible on the CCARDESA website: www.ccardesa.org.

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Abbreviations And Acronyms

AKVO	Ali Kebab Van Oxford
ALS	Angular Leafspot
APPSA	Agricultural Productivity Programme for Southern Africa
ATCC	Agricultural Technology Clearance Committee
BCMV	Bean Common Mosaic Virus
CA	Conservation Agriculture
CBB	Common Bacterial Blight
CCARDESA	Centre for Coordination of Agricultural Research and Development for Southern Africa
CHC	Commodity Holding Company
CO_2	Carbon Dioxide
CoPI	Co- Principal Investigator
CSA	Climate Smart Agriculture
CYMMIT	International Maize and Wheat Improvement Center
DW	Dry weight
FFD	Farmer Field Days
FFS	Farmer Field Schools
GLS	Grey Leaf Spot
HA	Hectare
ICKM	Information, Communication and Knowledge Management
ICRISAT	International Crops Research Institute for the Semi-Arid Tropics
ICT	Information Communication and Technologies
IEC	Information, Education and Communication
IIAM	Instituto de Investigação Agrária de Moçambique
IITA	International Institute of Tropical Agriculture
IPDM	Integrated Pest and Disease Management
ISPM	Instituto Superior Politécnico de Manica
LUANAR	Lilongwe University of Agriculture and Natural Resources
MIS	Management Information System
MLND	Maize Lethal Necrotic Disease
MoA	Ministry of Agriculture
MSV	Maize Streak Virus
NARS	National Agricultural Research Systems

NGO	Non-Government Organization
OPV	Open Pollinated Variety
PI	Principal Investigator
PICS	Purdue Improved Cowpea Storage
PST	Polyethylene Silo Tank
QPM	Quality Protein Maize
R&D	Research and Development
R4D	Research for Development
RCoLs	Regional Centres of Leaderships
SAAIKS	Southern African Agricultural Information and Knowledge System
SADC	Southern Africa Development Community
SD	Seed Department
SGB	Super Grain Bags
SHF	Smallholder Farmers
SME	Small and Medium Enterprises
TIMPs	Technologies, Innovations and Management Practices
TLB	Turcicum Leaf Blight
TLC	Total Land Care
USA	United States of America
VCU	Value for Cultivation and Use
WB	World Bank
ZARI	Zambia Agricultural Research Institute

1.0 Technologies For Maize And Maize-Based Systems

1.1 Pro-vitamin A, drought and Low "N" tolerant maize varieties

1.1.1 Maize variety: MMV409

Title of the technology or innovation	MMV409 is Pro-vitamin A, drought and Low "N" tolerant maize variety
Description of the technology	MMV409 is a white, semi-flint open pollinated variety and can be recycled up to 3 times. It takes 120 to 130 days to maturity and yield potential is 6tons/ha. Other characteristics include tolerance to drought and low nitrogen and moderately tolerant to Grey Leaf Spot (GLS). It is suitable for region I and II of Zambia.
End users of the technology	The end users of the technology are smallholder farmers, researchers and extension staff.
Critical and essential factors for successful promotion and adoption of the technology	There is need for strong research-extension linkages, improved capacity among agro-dealers and seed stockists. In addition, the seed should be readily available and accessible. Widespread on-farm demonstrations are required to create awareness among farmers.
Anticipated challenges in respect to further dissemination of the technology, adoption and up/out scaling	To facilitate further dissemination of the technology the farmer preferred varieties need to be readily available on the market and field extension staff require adequate training on the technology and need to be mobile so that they can easily reach out to the end users
Recommendations for addressing the challenges listed above	If the field extension staff are mobile and equipped with the right knowledge, then there will be improved monitoring of activities at agricultural camp and district levels. There is need to identify and support seed companies/seed growers' associations and engage them to facilitate scaling up the multiplication and marketing of farmer preferred varieties
Lessons learnt on the best ways for addressing the challenges listed above	The following are some of the approaches that could facilitate dissemination of the technology: • Support and encourage farmer exchange visits and strengthen the Lead Farmer-Follower farmer concept, • Consistency in the variety package is critical across seasons • Regular Extension-Farmer interactions at field level, Support needs to be given to private sector partners who are willing to multiply and market the farmer preferred varieties. Need to intensify publicity

Gender concern in the development and dissemination of the technology	There is still a need to emphasize on the nutrition aspect of the maize orange variety-utilization especially among children, pregnant and breast-feeding mothers. Need to deliberately target women farmer clubs with the maize technologies, both production and utilization
Additional important information about the technology	There is need to integrate schools and health institutions in the production and utilization of orange maize. The is a need to link farmers to the consumers and traders of orange maize
Contact details of the generators and promotors of the technology	Zambia Agriculture Research Institute Email address: zaridirector@zari.gov.zm or mwalemp@yahoo.com, Telephone: +260 211 278130, Mobile: +260 966 766395 Country: Zambia Department of Agriculture Email address: pklungu@yahoo.com, Telephone: +260 211 252029, Mobile: +260 966 803868Country: Zambia Department of Agriculture Email address: emchuma@yahoo.co.uk, Telephone: +260 211 223313Mobile: +260 977764097 Country: Zambia

1.1.2 Maize variety: ZM 421

Title of the technology or innovation	Pro-vitamin A, drought and Low “N” tolerant maize variety: ZM 421
Description of the technology	ZM 421 is an Open Pollinated Variety (OPV) and can be recycled up to 3 times. It matures within 115 to 125 days. Other important characteristics include, moderately tolerant to Grey Leaf Spot (GLS), tolerant to drought and requires low nitrogen, yield potential is 4tons/ha. (80 X 50kg bags) and suitable for regions I and II of Zambia
End users of the technology	The end users of the technology are smallholder farmers, researchers and extension staff.
Critical and essential factors for successful promotion and adoption of the technology	Successful promotion and adoption of ZM 421 requires strong Research-Extension Linkages, improved capacity among agro-dealers and seed stockists, improved seed availability and accessibility and intensified on-farm demonstrations.

Anticipated challenges encountered in respect to further dissemination of the technology, adoption and up/ out scaling	To facilitate further dissemination of the technology the farmer preferred varieties need to be readily available on the market and field extension staff require adequate training on the technology and need to be mobile so that they can easily reach out to the end users
Recommendations for addressing the challenges listed above	If the field extension staff are mobile and equipped with the right knowledge, then there will be improved monitoring of activities at agricultural camp and district levels. There is need to identify and support seed companies/seed growers' associations and engage them to facilitate scaling up the multiplication and marketing of farmer preferred varieties
Lessons learnt on the best ways for addressing the challenges listed above	The following are some of the approaches that could facilitate dissemination of the technology: (i) support and encourage farmer exchange visits and strengthen the Lead Farmer-Follower farmer concept, (ii) Consistency in the variety package is critical across seasons, (iii) Regular Extension-Farmer interactions at field level, (iv) Support needs to be given to private sector partners who are willing to multiply and market the farmer preferred varieties and finally (v) the need to intensify publicity.
Gender concern in the development and dissemination of the technology	There is still a need to emphasize on the nutrition aspect of the maize orange variety-utilization especially among children, pregnant and breast-feeding mothers. Need to deliberately target women farmer clubs with the maize technologies, both production and utilization
Additional important information about the technology	There is need to integrate schools and health institutions in the production and utilization of orange maize. The is a need to link farmers to the consumers and traders of orange maize
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1.1.3 Maize variety: ZMS 402

Title of the technology or innovation	Pro-vitamin A, drought and Low "N" tolerant maize variety: ZMS 402
Description of the technology	ZMS 402 is a very early maturing hybrid and matures within 100 to 105 days. It is a white and flint hard grain, tolerant to drought and lodging, resistance to all common leafy diseases with a yield potential is 7T/ha (140 X 50 kg bags).
End users of the technology	The end users of the technology are smallholder farmers, researchers and extension staff.
Critical and essential factors for successful promotion and adoption of the technology	Successful promotion and adoption of ZM 421 requires strong Research-Extension Linkages, improved capacity among agro-dealers and seed stockists, improved seed availability and accessibility and intensified on-farm demonstrations.
Anticipated challenges encountered in respect to further dissemination of the technology, adoption and up/out scaling	To facilitate further dissemination of the technology the farmer preferred varieties need to be readily available on the market and field extension staff require adequate training on the technology and need to be mobile so that they can easily reach out to the end users
Recommendations for addressing the challenges listed above	If the field extension staff are mobile and equipped with the right knowledge, then there will be improved monitoring of activities at agricultural camp and district levels. There is need to identify and support seed companies/seed growers' associations and engage them to facilitate scaling up the multiplication and marketing of farmer preferred varieties. Improved monitoring of activities at agricultural camp and district levels, need to identify and support seed companies/seed growers' associations that could be engaged in scaling up the multiplication and marketing of farmer preferred varieties
Lessons learnt on the best ways for addressing the challenges listed above	It has been noted that providing adequate support and encouraging farmer exchange visits, strengthening the farmer field school concept, consistency in the variety package across seasons, regular Extension-Farmer interactions at field level and intensified publicity are among the factors that can facilitate quick adoption of the variety. In addition, the private sector partners who have shown interest and willingness to multiply and market the farmer preferred varieties would facilitate availability and accessibility of the variety among smallholder farmers

Gender concern in the development and dissemination of the technology	There is still a need to emphasize on the nutrition aspect of the maize orange variety-utilization especially among children, pregnant and breast-feeding mothers. There is need to be proactive and deliberately target women farmer clubs with the maize technologies, both production and utilization
Additional important information about the technology	There is need to integrate schools and health institutions in the production and utilization of orange maize. The is a need to link farmers to the consumers and traders of orange maize
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1.1.4 Maize variety: GV421

Title of the technology or innovation	Pro-vitamin A, drought and Low “N” tolerant maize variety: GV421
Description of the technology	GV421 is a white dent and matures within a period of 115-125 days. It adapts very well to regions I and II. It is resistant to all leaf blight diseases and has a yield potential of 4 t/ha.
End users of the technology	The end users of the technology are smallholder farmers, researchers and extension staff.
Critical and essential factors for successful promotion and adoption of the technology	Successful promotion and adoption of ZM 421 requires strong Research-Extension Linkages, improved capacity among agro-dealers and seed stockists, improved seed availability and accessibility and intensified on-farm demonstrations.
Anticipated challenges encountered in respect to further dissemination of the technology, adoption and up/out scaling	To facilitate further dissemination of the technology the farmer preferred varieties need to be readily available on the market and field extension staff require adequate training on the technology and need to be mobile so that they can easily reach out to the end users

Recommendations for addressing the challenges listed above	To address the anticipated challenges there is need to intensify monitoring activities at agricultural camp and district levels, to identify and support seed companies/seed growers' associations that could be engaged in scaling up the multiplication and marketing of farmer preferred varieties
Lessons learnt on the best ways for addressing the challenges listed above	It has been noted that providing adequate support and encouraging farmer exchange visits, strengthening the farmer field school concept, consistency in the variety package across seasons, regular Extension-Farmer interactions at field level and intensified publicity are among the factors that can facilitate quick adoption of the variety. In addition, the private sector partners who have shown interest and willingness to multiply and market the farmer preferred varieties would facilitate availability and accessibility of the variety among smallholder farmers
Gender concern in the development and dissemination of the technology	There is still needed to emphasize on the nutrition aspect of the maize orange variety-utilization especially among children, pregnant and breast-feeding mothers. Need to deliberately target women farmer clubs with the maize technologies, both production and utilization
Additional important information about the technology	There is need to integrate schools and health institutions in the production and utilization of orange maize. The is needed to link farmers to the consumers and traders of orange maize
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1.1.5 Maize variety: GV635

Title of the technology or innovation	Pro-vitamin A, drought and Low "N" tolerant maize variety: GV635

Description of the technology	GV635 is a white semi-flint grain with maturity period of 125-135 days. It is drought resistant and adapts very well in regions I, II, III and is very tolerant to maize streak virus. GV635 has yield potential of 11 t/ha and is tolerant to diseases like GLS and Leaf Blight.
End users of the technology	The end users of the technology are smallholder farmers, researchers and extension staff.
Critical and essential factors for successful promotion and adoption of the technology	Successful promotion and adoption of ZM 421 requires strong Research-Extension Linkages, improved capacity among agro-dealers and seed stockists, improved seed availability and accessibility and intensified on-farm demonstrations.
Challenges encountered in respect to further dissemination of the technology, adoption and up/out scaling	To facilitate further dissemination of the technology the farmer preferred varieties need to be readily available on the market and field extension staff require adequate training on the technology and need to be mobile so that they can easily reach out to the end users
Recommendations for addressing the challenges listed above	To address the anticipated challenges there is need to intensify monitoring activities at agricultural camp and district levels, to identify and support seed companies/seed growers' associations that could be engaged in scaling up the multiplication and marketing of farmer preferred varieties
Lessons learnt on the best ways for addressing the challenges listed above	It has been noted that providing adequate support and encouraging farmer exchange visits, strengthening the farmer field school concept, consistency in the variety package across seasons, regular Extension-Farmer interactions at field level and intensified publicity are among the factors that can facilitate quick adoption of the variety. In addition, the private sector partners who have shown interest and willingness to multiply and market the farmer preferred varieties would facilitate availability and accessibility of the variety among smallholder farmers
Gender concern in the development and dissemination of the technology	There is still a need to emphasize on the nutrition aspect of the maize orange variety-utilization especially among children, pregnant and breast-feeding mothers. Need to deliberately target women farmer clubs with the maize technologies, both production and utilization
Additional important information about the technology	There is need to integrate schools and health institutions in the production and utilization of orange maize. The is a need to link farmers to the consumers and traders of orange maize

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1.1.6 Maize variety: GV638

Title of the technology or innovation	Pro-vitamin A, drought and Low "N" tolerant maize variety: GV638
Description of the technology	GV635 is a white semi-flint grain with maturity period of 125-135 days. It is drought resistant and adapts very well in regions I, II, III and is very tolerant to maize streak virus. GV635 has yield potential of : 10 t/ha and is tolerant to diseases like Cob rot, GLS Maize Steak virus and Leaf Blight.
End users of the technology	The end users of the technology are smallholder farmers, researchers and extension staff.
Critical and essential factors for successful promotion and adoption of the technology	Smallholder farmers and Research-Extension
Challenges encountered in respect to further dissemination of the technology, adoption and up/out scaling	Successful promotion and adoption of ZM 421 requires strong Research-Extension Linkages, improved capacity among agro-dealers and seed stockists, improved seed availability and accessibility and intensified on-farm demonstrations.
Recommendations for addressing the challenges listed above	To facilitate further dissemination of the technology the farmer preferred varieties need to be readily available on the market and field extension staff require adequate training on the technology and need to be mobile so that they can easily reach out to the end users

Lessons learnt on the best ways for addressing the challenges listed above	To address the anticipated challenges there is need to intensify monitoring activities at agricultural camp and district levels, to identify and support seed companies/seed growers' associations that could be engaged in scaling up the multiplication and marketing of farmer preferred varieties
Gender concern in the development and dissemination of the technology	There is still a need to emphasize on the nutrition aspect of the maize orange variety-utilization especially among children, pregnant and breast-feeding mothers. Need to deliberately target women farmer clubs with the maize technologies, both production and utilization
Additional important information about the technology	There is need to integrate schools and health institutions in the production and utilization of orange maize. The is need to link farmers to the consumers and traders of orange maize
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1.1.7 Maize variety: GV662A

Title of the technology or innovation	Pro-vitamin A, drought and Low "N" tolerant maize variety: GV662A
Description of the technology	GV662A is a Hybrid, Orange, semi-flint grain with maturing period of 115 to 125 days. It contains Pro-Vitamin A (7pg/g ProA) and has a yield potential of 7-9T/ha. (140-180 X 50kg bags). It is suitable for regions II and III and is moderately tolerant to Blight, ear rots, Grey Leaf Spot (GLS) and rust.
End users of the technology	The end users of the technology are smallholder farmers, researchers and extension staff.

Critical and essential factors for successful promotion and adoption of the technology	Successful promotion and adoption of ZM 421 requires strong Research-Extension Linkages, improved capacity among agro-dealers and seed stockists, improved seed availability and accessibility and intensified on-farm demonstrations.
Challenges encountered in respect to further dissemination of the technology, adoption and up/out scaling	To facilitate further dissemination of the technology the farmer preferred varieties need to be readily available on the market and field extension staff require adequate training on the technology and need to be mobile so that they can easily reach out to the end users
Recommendations for addressing the challenges listed above	To address the anticipated challenges there is need to intensify monitoring activities at agricultural camp and district levels, to identify and support seed companies/seed growers' associations that could be engaged in scaling up the multiplication and marketing of farmer preferred varieties
Lessons learnt on the best ways for addressing the challenges listed above	It has been noted that providing adequate support and encouraging farmer exchange visits, strengthening the farmer field school concept, consistency in the variety package across seasons, regular Extension-Farmer interactions at field level and intensified publicity are among the factors that can facilitate quick adoption of the variety. In addition, the private sector partners who have shown interest and willingness to multiply and market the farmer preferred varieties would facilitate availability and accessibility of the variety among smallholder farmers
Gender concern in the development and dissemination of the technology	There is still a need to emphasize on the nutrition aspect of the maize orange variety-utilization especially among children, pregnant and breast-feeding mothers. Need to deliberately target women farmer clubs with the maize technologies, both production and utilization
Additional important information about the technology	There is need to integrate schools and health institutions in the production and utilization of orange maize. The is a need to link farmers to the consumers and traders of orange maize
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1.2 Pro-Vitamin A maize varieties

1.2.1 Maize variety: MH45A (APPSA03)

Title of the technology or innovation	Pro-vitamin A maize: **MH45A (APPSA03)**
Description of the technology	MH45A (APPSA03) Pro-vitamin A maize variety. It is poundable with flint kernel texture (1.9), has an average plant height of 137cm and an ear height of 58cm and is tolerant to Grey leaf spot Cercospora zea-maydis, MSV, rust Puccinia spp and leaf blight Exserohilum turcicum. MH45A has Vitamin A levels of 5.5 **µg**/g and carotene colour intensity score of 2.1. Poultry farmers are encouraged to use it in feeds to improve colour of eggs.
End users of the technology	The end users of the technology are smallholder farmers, researchers and extension staff.
Critical and essential factors for successful promotion and adoption of the technology	To successful promote the adoption of MH45A (APPSA03, it will be important to establish strong links with other stakeholders particularly those dealing with heath and nutritional matters so that they can help in creating awareness on the importance of consuming orange maize. In addition, it is also important to ensure easy availability and accessibility of seed on the market.
Anticipated challenges encountered in respect to further dissemination of the technology, adoption and up/ out scaling	The beneficiaries in Southern Africa are not used to orange maize as such might have negative perceptions in up of the product or the by products

Figure 3: MH45A (APPSA03) maize variety

Recommendations for addressing the challenges listed above	Countries need to put in place dissemination strategies On the health and nutrition benefits of consuming orange maize and its products
Lessons learnt on the best ways for addressing the challenges listed above	The uptake of the technology requires creation of strong partnerships with key stakeholders
Gender concern in the development and dissemination of the technology	The nutritional component attracts women more than men in adopting the technology, since women are generally responsible for preparing food for the household.
Additional important information about the technology	There is need to integrate schools and health institutions in the production and utilization of orange maize. The is a need to link farmers to the consumers and traders of orange maize
Contact details of the generators and promotors of the technology	Dr. K. Kaonga, Maize Research Commodity Team Leader, Chitedze Research Department of Agricultural Research Services (DARS) P.O. Box 30779. Lilongwe 3, Malawi

1.2.2. Maize variety: MH46A (APPSA06)

Title of the technology or innovation	Pro-vitamin A maize: **MH46A (APPSA06)**
Description of the technology	MH46A has a yield potential of 8tons/ha and matures in 128days. The level of vitamin A is 6.5ug/g, zeaxanthin is 8.7ug/g DW, carotene colour intensity score is 1.8

Figure 4: MH46A (APPSA06) maize variety

End users of the technology	The end users of the technology are smallholder farmers, researchers and extension staff.
Critical and essential factors for successful promotion and adoption of the technology	To successful promote the adoption of MH45A (APPSA03, it will be important to establish strong links with other stakeholders particularly those dealing with heath and nutritional matters so that they can help in creating awareness on the importance of consuming orange maize. In addition, it is also important to ensure easy availability and accessibility of seed on the market.
Challenges encountered in respect to further dissemination of the technology, adoption and up/out scaling	The beneficiaries in Southern Africa are not used to orange maize as such might have negative perceptions in up of the product or the by products
Recommendations for addressing the challenges listed above	Countries need to put in place dissemination strategies on the health and nutrition benefits of consuming orange maize and its products
Lessons learnt on the best ways for addressing the challenges listed above	The uptake of the technology requires creation of strong partnerships with key stakeholders
Gender concern in the development and dissemination of the technology	The nutritional component attracts women more than men in adopting the technology, since women are generally responsible for preparing food for the household.
Additional important information about the technology	There is need to integrate schools and health institutions in the production and utilization of orange maize. The is a need to link farmers to the consumers and traders of orange maize
Contact details of the generators and promotors of the technology	Dr. K. Kaonga, Maize Research Commodity Team Leader, Chitedze Research Department of Agricultural Research Services (DARS) P.O. Box 30779. Lilongwe 3, Malawi.

1.2.3 Maize variety: MH47A (APPSA08)

Title of the technology or innovation	Pro-vitamin A maize: **MH47A (APPSA08)**
Description of the technology	MH47A has a yield potential of 7tons/ha and matures in 130days. The level of vitamin A is 4.8ug/g, zeaxanthin is 7.5ug/g DW, carotene colour intensity score is 2.8.

End users of the technology	The end users of the technology are smallholder farmers, researchers and extension staff.
Critical and essential factors for successful promotion and adoption of the technology	To successful promote the adoption of MH45A (APPSA03, it will be important to establish strong links with other stakeholders particularly those dealing with heath and nutritional matters so that they can help in creating awareness on the importance of consuming orange maize. In addition, it is also important to ensure easy availability and accessibility of seed on the market.
Challenges encountered in respect to further dissemination of the technology, adoption and up/out scaling	The beneficiaries in Southern Africa are not used to orange maize as such might have negative perceptions in up of the product or the by products
Recommendations for addressing the challenges listed above	Countries need to put in place dissemination strategies on the health and nutrition benefits of consuming orange maize and its products
Lessons learnt on the best ways for addressing the challenges listed above	The uptake of the technology requires creation of strong partnerships with key stakeholders
Gender concern in the developmentanddissemination of the technology	The nutritional component attracts women more than men in adopting the technology, since women are generally responsible for preparing food for the household.
Additional important information about the technology	There is need to integrate schools and health institutions in the production and utilization of orange maize. The is a need to link farmers to the consumers and traders of orange maize
Contact details of the generators and promotors of the technology	Dr. K. Kaonga, Maize Research Commodity Team Leader, Chitedze Research Department of Agricultural Research Services (DARS) P.O. Box 30779. Lilongwe 3, Malawi

1.2.4 Maize variety: MH48A (APPSA09)

Title of the technology or innovation	Pro-vitamin A maize: **MH48A (APPSA09)**
Description of the technology	MH48A has a yield potential of 7tons/ha and matures in 130days. The level of vitamin A is 5.6ug/g, zeaxanthin is 5.6ug/g DW, carotene colour intensity score is 2.4.
End users of the technology	The end users of the technology are smallholder farmers, researchers and extension staff.

Critical and essential factors for successful promotion and adoption of the technology	To successful promote the adoption of MH45A (APPSA03, it will be important to establish strong links with other stakeholders particularly those dealing with heath and nutritional matters so that they can help in creating awareness on the importance of consuming orange maize. In addition, it is also important to ensure easy availability and accessibility of seed on the market.
Anticipated challenges encountered in respect to further dissemination of the technology, adoption and up/ out scaling	The beneficiaries in Southern Africa are not used to orange maize as such might have negative perceptions in up of the product or the by products
Recommendations for addressing the challenges listed above	Countries need to put in place dissemination strategies on the health and nutrition benefits of consuming orange maize and its products.
Lessons learnt on the best ways for addressing the challenges listed above	The uptake of the technology requires creation of strong partnerships with key stakeholders
Gender concern in the development and dissemination of the technology	The nutritional component attracts women more than men in adopting the technology, since women are generally responsible for preparing food for the household.
Additional important information about the technology	There is need to integrate schools and health institutions in the production and utilization of orange maize. The is a need to link farmers to the consumers and traders of orange maize
Contact details of the generators and promotors of the technology	Dr. K. Kaonga, Maize Research Commodity Team Leader, Chitedze Research Department of Agricultural Research Services (DARS) P.O. Box 30779. Lilongwe 3, Malawi

1.2.5 Maize variety: MH49A (APPSA13)

Title of the technology or innovation	Pro-vitamin A maize: **MH49A (APPSA13)**
Description of the technology	MH49A has a yield potential of 6tons/ha and matures in 132days. The level of vitamin A is 3.4 ug/g, zeaxanthin is 9.3.5ug/g DW, carotene colour intensity score is 2.1

Figure 5: MH49A (APPSA13) maize variety

End users of the technology	The end users of the technology are smallholder farmers, researchers and extension staff.
Critical and essential factors for successful promotion and adoption of the technology	To successful promote the adoption of MH45A (APPSA03, it will be important to establish strong links with other stakeholders particularly those dealing with heath and nutritional matters so that they can help in creating awareness on the importance of consuming orange maize. In addition, it is also important to ensure easy availability and accessibility of seed on the market.
Anticipated challenges encountered in respect to further dissemination of the technology, adoption and up/out scaling	The beneficiaries in Southern Africa are not used to orange maize as such might have negative perceptions in up of the product or the by products
Recommendations for addressing the challenges listed above	Countries need to put in place dissemination strategies on the health and nutrition benefits of consuming orange maize and its products
Lessons learnt on the best ways for addressing the challenges listed above	The uptake of the technology requires creation of strong partnerships with key stakeholders
Gender concern in the development and dissemination of the technology	The nutritional component attracts women more than men in adopting the technology, since women are generally responsible for preparing food for the household.
Additional important information about the technology	There is need to integrate schools and health institutions in the production and utilization of orange maize. The is a need to link farmers to the consumers and traders of orange maize
Contact details of the generators and promotors of the technology	Dr. K. Kaonga, Maize Research Commodity Team Leader, Chitedze Research Department of Agricultural Research Services (DARS) P.O. Box 30779. Lilongwe 3, Malawi

1.3 Striga tolerant maize varieties

1.3.1 Maize variety: MH50STR (0501-2STR)

Title of the technology or innovation	Striga tolerant maize - **MH50STR (0501-2STR**
Description of the technology	This variety possesses traits of resistance to striga, high yielding (7tons/ha), medium maturity and resistant to major diseases It matures in 120 days, has flint grain texture and is white in colour
End users of the technology	The beneficiaries of the project results are smallholder farmers, Medium farmers and Seed producers
Critical and essential factors for successful promotion and adoption of the technology	To effectively promote the adoption of the technology there is need for make seed readily available and create strong linkages amongst stakeholders along the maize value chain
Anticipated challenges encountered in respect to further dissemination of the technology, adoption and up/ out scaling	None
Recommendations for addressing the challenges listed above	Improved coordination among stakeholders in maize value chain. There should be a strong linkage between the extension services and the farming community
Lessons learnt on the best ways for addressing the challenges listed above	Effective engagement of key stakeholders improved the delivery of the technologies.

Figure 6: MH50STR (0501-2STR maize variety

Gender concern in the development and dissemination of the technology	Women farmers will particularly benefit from these new maize varieties because smallholder farm operations, in the three countries, are mostly done by women. These new striga resistant maize varieties will also benefit youth farmers in target areas.
Additional important information about the technology	The technology is being implemented in major maize growing areas in Malawi, Mozambique and Zambia where striga parasitic weeds are a problem
Contact details of the generators and promotors of the technology	Chitedze Research Station, P.O. Box 158, Lilongwe, Malawi. Name: Cyprian Mwale Email address: mwalecyprian@gmail.com, Mobile: +2651707222/041, Country: Malawi IIAM-CZC (Sussundenga), Email address: manueltemo@gmail.com, Mobile: +258-82-51-79-965 Country: Mozambique ZARI, Box 80908, Kabwe, Zambia, Email address: abrahammukobe@gmail.com, Mobile: +26096847509, Country: Zambia

1.3.2 Maize variety: MH51STR (1113-1STR)

Title of the technology or innovation	Striga tolerant maize - **MH51STR (1113-1STR)**
Description of the technology	MH51STR (1113-1STR) variety has traits of resistance to striga, high yielding (6.2tons/ha), medium maturity and resistant to major diseases It matures in 125 days, has flint grain texture and is white in colour

Figure 7: MH51STR (1113-1STR) maize variety

End users of the technology	The beneficiaries of the project results are smallholder farmers, Medium farmers and Seed producers
Critical and essential factors for successful promotion and adoption of the technology	To effectively promote the adoption of the technology there is need for make seed readily available and create strong linkages amongst stakeholders along the maize value chain
Anticipated challenges encountered in respect to further dissemination of the technology, adoption and up/out scaling	None
Recommendations for addressing the challenges listed above	Improved coordination among stakeholders in maize value chain. There should be a strong linkage between the extension services and the farming community
Lessons learnt on the best ways for addressing the challenges listed above	Effective engagement of key stakeholders improved the delivery of the technologies.
Gender concern in the development and dissemination of the technology	Women farmers will particularly benefit from these new maize varieties because smallholder farm operations, in the three countries, are mostly done by women. These new striga resistant maize varieties will also benefit youth farmers in target areas.
Additional important information about the technology	The technology is being implemented in major maize growing areas in Malawi, Mozambique and Zambia where striga parasitic weeds are a problem
Contact details of the generators and promotors of the technology	Chitedze Research Station, P.O. Box 158, Lilongwe, Malawi. Name: Cyprian Mwale Email address: mwalecyprian@gmail.com, Mobile: +2651707222/041, Country: Malawi IIAM-CZC (Sussundenga) Email address: manueltemo@gmail.com Mobile: +258-82-51-79-965 Country: Mozambique ZARI, Box 80908, Kabwe, Zambia, Email address: abrahammukobe@gmail.com, Mobile: +26096847509, Country: Zambia

1.3.3 Maize variety: MH52STR (1113-1STR)

Title of the technology or innovation	Striga tolerant maize - **MH52STR (11113-5STR)**
Description of the technology	**- MH52STR (11113-5STR) has traits of resistance to striga, high yielding (6tons/ha), medium maturity and resistant to major diseases It matures in 130 days, has flint grain texture and is white in colour**
End users of the technology	The beneficiaries of the project results are smallholder farmers, Medium farmers and Seed producers
Critical and essential factors for successful promotion and adoption of the technology	To effectively promote the adoption of the technology there is need for make seed readily available and create strong linkages amongst stakeholders along the maize value chain
Anticipated challenges encountered in respect to further dissemination of the technology, adoption and up/out scaling	None
Recommendations for addressing the challenges listed above	Improved coordination among stakeholders in maize value chain. There should be a strong linkage between the extension services and the farming community
Lessons learnt on the best ways for addressing the challenges listed above	Effective engagement of key stakeholders improved the delivery of the technologies.
Gender concern in the development and dissemination of the technology	Women farmers will particularly benefit from these new maize varieties because smallholder farm operations, in the three countries, are mostly done by women. These new striga resistant maize varieties will also benefit youth farmers in target areas.

Figure 8: MH52STR (11113-5STR) maize variety

Additional important information about the technology	The technology is being implemented in major maize growing areas in Malawi, Mozambique and Zambia where striga parasitic weeds are a problem
Contact details of the generators and promotors of the technology	Chitedze Research Station, P.O. Box 158, Lilongwe, Malawi. Name: Cyprian Mwale Email address: mwalecyprian@gmail.com, Mobile: +2651707222/041, Country: Malawi IIAM-CZC (Sussundenga) Email address: manueltemo@gmail.com Mobile: +258-82-51-79-965 Country: Mozambique ZARI, Box 80908, Kabwe, Zambia, Email address: abrahammukobe@gmail.com, Mobile: +26096847509, Country: Zambia

1.3.4 Maize variety - MZ1 (OPV)

Title of the technology or innovation	Striga tolerant maize variety - MZ1 (OPV)
Description of the technology	MZ1 (OPV) variety is early and is suitable in short to medium rainfall areas. and the seed can be recycled for at least three cropping seasons. It is a high yielding variety and tolerant to striga.
End users of the technology	The beneficiaries of the project results are smallholder farmers, Medium farmers and Seed producers
Critical and essential factors for successful promotion and adoption of the technology	Availability of material and financial resources -Integration Of all stakeholders in maize value chain and involvement of extension services
Challenges encountered in respect to further dissemination of the technology, adoption and up/out scaling	Sensitize producers to change attitudes and cultural practices of mono cropping than using the techniques of integrated rotation and varieties tolerant to striga. - The extension should take the lead in disseminating innovations
Recommendations for addressing the challenges listed above	Improving coordination of rural extension services, IITA-Nigeria, CIMMTY in Zimbabwe and seed producing companies should work in collaboration to control striga weed
Lessons learnt on the best ways for addressing the challenges listed above	The farmer should apply good agronomic practices in the field, - There should be a good linkage between the extension service and the farming community
Gender concern in the development and dissemination of the technology	Both male and female should actively participate in regard of their gender roles in agriculture production in order to increase yield

Additional important information about the technology	Soils which are infested with striga weed affect the soil nutrient uptake of the Crop plant as it also depends on feeding on plant nutrients and moisture in the soil. -Smallholder farmers do not have much knowledge about the agronomic management practices on how to control this weed.
Contact details of the generators and promotors of the technology	Chitedze Research Station, P.O. Box 158, Lilongwe, Malawi. Name: Cyprian Mwale Email address: mwalecyprian@gmail.com, Mobile: +2651707222/041, Country: Malawi. IIAM-CZC (Sussundenga) Email address: manueltemo@gmail.com Mobile: +258-82-51-79-965 Country: Mozambique. ZARI, Box 80908, Kabwe, Zambia, Email address: abrahammukobe@gmail.com, Mobile: +26096847509, Country: Zambia.

1.3.5 Maize variety - MZ2 (Hybrid)

Title of the technology or innovation	Striga tolerant maize variety MZ2 = (Hybrid)
Description of the technology	MZ2 = (Hybrid) variety is early and is suitable in short to medium rainfall areas. and the seed can be recycled for at least three cropping seasons. It is a high yielding variety and tolerant to striga.
End users of the technology	The beneficiaries of the project results are smallholder farmers, Medium farmers and Seed producers
Critical and essential factors for successful promotion and adoption of the technology	Availabilitytheseedandaffordabilityonthepartofthefarmer Integration Of all stakeholders in maize value chain and involvement of extension services
Anticipated challenges encountered in respect to further dissemination of the technology, adoption and up/out scaling	Sensitize producers to change attitudes and cultural practices of mono cropping than using the techniques of integrated rotation and varieties tolerant to striga. - The extension should take the lead in disseminating innovations
Recommendations for addressing the challenges listed above	Improving coordination of rural extension services, - IITA-Nigeria, CIMMTY in Zimbabwe and seed producing companies should work in collaboration to control striga weed
Lessons learnt on the best ways for addressing the challenges listed above	The farmers applying the technology should be encouraged to apply good agronomic practices as well. Strengthened linkage between the extension service and the farming community

Gender concern in the development and dissemination of the technology	Both male and female should actively participate in regard of their gender roles in agriculture production in order to increase yield
Additional important information about the technology	Soils which are infested with striga weed affect the soil nutrient uptake of the Crop plant as it also depends on feeding on plant nutrients and moisture in the soil. -Smallholder farmers do not have much knowledge about the agronomic management practices on how to control this weed.
Contact details of the generators and promotors of the technology	Chitedze Research Station, P.O. Box 158, Lilongwe, Malawi. Name: Cyprian Mwale Email address: mwalecyprian@gmail.com, Mobile: +2651707222/041, Country: Malawi IIAM-CZC (Sussundenga) Email address: manueltemo@gmail.com Mobile: +258-82-51-79-965 Country: Mozambique ZARI, Box 80908, Kabwe, Zambia, Email address: abrahammukobe@gmail.com, Mobile: +26096847509, Country: Zambia

1.3.6 Maize variety - Sussuma (QPM)

Title of the technology or innovation	Striga tolerant maize variety - Sussuma (QPM)
Description of the technology	Sussuma (QPM) is a semi-flint variety tolerant to striga. It produces 3-6 tons ha^{-1}. Under irrigation, the variety takes 130- 135 to mature while under rainfed it takes 142 – 147 days. It is also moderately resistant to mildews.
End users of the technology	The users of the technology are smallholder farmers in three different agro-ecological zones of Malawi, millers, researchers and extension staff.
Critical and essential factors for successful promotion and adoption of the technology	It is critical and essential to strengthen research-extension linkages in order to enhance collaboration, utilization and scaling-up of the technology. Availability and accessibility of improved seed, scaling-up of on-farm demonstrations and availing markets for the technology are also paramount for technology promotion and adoption.

Challenges encountered in respect to further dissemination of the technology, adoption and up/out scaling	Inadequate knowledge on the identification of diseases and pests in CA maize production cropping system amongst farmers, conflicting messages from different CA players on the appropriate CA technology packages, competing uses of maize stover, insufficient seed supply and low capacity of extension officers in sensitization of the technology were amongst the challenges encountered during the testing and dissemination of the technology.
Recommendations for addressing the challenges listed above	There is a need to (i) train farmers and extension workers on the identification and control measures of pests and diseases in CA cropping systems; (ii) harmonize information on the CA technology package; (iii) identify alternative materials for use in covering the soil in CA other than reliance on maize crop residues only.
Lessons learnt on the best ways for addressing the challenges listed above	Involvement of farmers, extension officers and all existing NGOs in the community is key towards popularizing the technologies. Farmer to farmer extension, regular trainings of farmers and farmer exchange visits promote technology dissemination. It was also noted that demonstrations are effective in disseminating the technology to wider groups of farmers. This created awareness of the technology through oral means, brochures, demonstration plots, drama/sketches.
Gender concern in the development and dissemination of the technology	Women can easily practice CA technology that is known not to be labour intensive.
Additional important information about the technology	None
Contact details of the generators and promotors of the technology	Ivy Ligowe, Chitedze Agriculture Research Institute. Department of Agricultural Research, Email address: ivyligowe@gmail.com. Mobile: +265 999 267 809, Country: Malawi Mathias Tembo, Zambia Agriculture Research Institute. Email address: mathiastembo2002@yahoo.com, Telephone: +260 211 278130 Mobile: +260 966 957408, ountry: Zambia Antonio Chamuene, IIAM, Email address: chamuene@gmail.com Mobile: +258 849082811 / +258 828664140 Country: Mozambique

1.4 Drought tolerant maize varieties

1.4.1 Maize variety - ZM-523

Title of the technology or innovation	Drought, GLS, MSV, rust and leaf blight tolerant maize variety - ZM-523
Description of the technology	ZM-523 is a drought tolerant variety with the potential yields ranging between 3-7 tons ha^{-1}. It takes 110 - 120 days to mature and is also resistant to striped leaf virus (MSV), **Cercospora zeae-maydis, Puccinia sorghum** and **Exserohilum turcicum**. ZM-523 shows moderately resistant to **Perenosclerospora sorghum.**
End users of the technology	The users of the technology are smallholder farmers in three different agro-ecological zones of Malawi, millers, researchers and extension staff.
Critical and essential factors for successful promotion and adoption of the technology	It is critical and essential to strengthen research-extension linkages in order to enhance collaboration, utilization and scaling-up of the technology. Availability and accessibility of improved seed, scaling-up of on-farm demonstrations and availing markets for the technology are also paramount for technology promotion and adoption.
Challenges encountered in respect to further dissemination of the technology, adoption and up/out scaling	Inadequate knowledge on the identification of diseases and pests in CA maize production cropping system amongst farmers, conflicting messages from different CA players on the appropriate CA technology packages, competing uses of maize stover, insufficient seed supply and low capacity of extension officers in sensitization of the technology were amongst the challenges encountered during the testing and dissemination of the technology.
Recommendations for addressing the challenges listed above	There is a need to (i) train farmers and extension workers on the identification and control measures of pests and diseases in CA cropping systems; (ii) harmonize information on the CA technology package; (iii) identify alternative materials for use in covering the soil in CA other than reliance on maize crop residues only.
Lessons learnt on the best ways for addressing the challenges listed above	Involvement of farmers, extension officers and all existing NGOs in the community is key towards popularizing the technologies. Farmer to farmer extension, regular trainings of farmers and farmer exchange visits promote technology dissemination. It was also noted that demonstrations are effective in disseminating the technology to wider groups of farmers. This created awareness of the technology through oral means, brochures, demonstration plots, drama/sketches.

Gender concern in the development and dissemination of the technology	Women can easily practice CA technology that is known not to be labour intensive.
Additional important information about the technology	None
Contact details of the generators and promotors of the technology	Ivy Ligowe, Chitedze Agriculture Research Institute. Department of Agricultural Research, Email address: ivyligowe@gmail.com. Mobile: +265 999 267 809, Country: Malawi Mathias Tembo, Zambia Agriculture Research Institute. Email address: mathiastembo2002@yahoo.com, Telephone: +260 211 278130 Mobile: +260 966 957408, country: Zambia Antonio Chamuene, IIAM, Email address: chamuene@gmail.com Mobile: +258 849082811 / +258 828664140 Country: Mozambique

1.4.2 Maize variety - PRIS 601

Title of the technology or innovation	Drought tolerant maize variety - PRIS 601
Description of the technology	PRIS 601 is a drought tolerant variety with the potential yields of 6 to 7tons per ha and matures in 125 to 135 days. It is also resistant to MSV and **Perenosclerospora sorghums.**
End users of the technology	The users of the technology are smallholder farmers in three different agro-ecological zones of Malawi, millers, researchers and extension staff.
Critical and essential factors for successful promotion and adoption of the technology	It is critical and essential to strengthen research-extension linkages in order to enhance collaboration, utilization and scaling-up of the technology. Availability and accessibility of improved seed, scaling-up of on-farm demonstrations and availing markets for the technology are also paramount for technology promotion and adoption.

Challenges encountered in respect to further dissemination of the technology, adoption and up/out scaling	Inadequate knowledge on the identification of diseases and pests in CA maize production cropping system amongst farmers, conflicting messages from different CA players on the appropriate CA technology packages, competing uses of maize stover, insufficient seed supply and low capacity of extension officers in sensitization of the technology were amongst the challenges encountered during the testing and dissemination of the technology.
Recommendations for addressing the challenges listed above	There is a need to (i) train farmers and extension workers on the identification and control measures of pests and diseases in CA cropping systems; (ii) harmonize information on the CA technology package; (iii) identify alternative materials for use in covering the soil in CA other than reliance on maize crop residues only.
Lessons learnt on the best ways for addressing the challenges listed above	Involvement of farmers, extension officers and all existing NGOs in the community is key towards popularizing the technologies. Farmer to farmer extension, regular trainings of farmers and farmer exchange visits promote technology dissemination. It was also noted that demonstrations are effective in disseminating the technology to wider groups of farmers. This created awareness of the technology through oral means, brochures, demonstration plots, drama/sketches.
Gender concern in the development and dissemination of the technology	Women can easily practice CA technology that is known not to be labour intensive.
Additional important information about the technology	None
Contact details of the generators and promotors of the technology	Ivy Ligowe, Chitedze Agriculture Research Institute. Department of Agricultural Research, Email address: ivyligowe@gmail.com. Mobile: +265 999 267 809, Country: Malawi Mathias Tembo, Zambia Agriculture Research Institute. Email address: mathiastembo2002@yahoo.com, Telephone: +260 211 278130 Mobile: +260 966 957408, country: Zambia Antonio Chamuene, IIAM, Email address: chamuene@gmail.com Mobile: +258 849082811 / +258 828664140 Country: Mozambique

1.4.3 Maize variety – Matuba

Title of the technology or innovation	Drought tolerant maize variety - Matuba
Description of the technology	Matuba is drought tolerant and resistant to MSV and Perenosclerospora sorghi. It produces 5-6 t ha^{-1} and takes 100-120 days to mature.
End users of the technology	The users of the technology are smallholder farmers in three different agro-ecological zones of Malawi, millers, researchers and extension staff.
Critical and essential factors for successful promotion and adoption of the technology	It is critical and essential to strengthen research-extension linkages in order to enhance collaboration, utilization and scaling-up of the technology. Availability and accessibility of improved seed, scaling-up of on-farm demonstrations and availing markets for the technology are also paramount for technology promotion and adoption.
Challenges encountered in respect to further dissemination of the technology, adoption and up/out scaling	Inadequate knowledge on the identification of diseases and pests in CA maize production cropping system amongst farmers, conflicting messages from different CA players on the appropriate CA technology packages, competing uses of maize stover, insufficient seed supply and low capacity of extension officers in sensitization of the technology were amongst the challenges encountered during the testing and dissemination of the technology.
Recommendations for addressing the challenges listed above	There is a need to (i) train farmers and extension workers on the identification and control measures of pests and diseases in CA cropping systems; (ii) harmonize information on the CA technology package; (iii) identify alternative materials for use in covering the soil in CA other than reliance on maize crop residues only.
Lessons learnt on the best ways for addressing the challenges listed above	Involvement of farmers, extension officers and all existing NGOs in the community is key towards popularizing the technologies. Farmer to farmer extension, regular trainings of farmers and farmer exchange visits promote technology dissemination. It was also noted that demonstrations are effective in disseminating the technology to wider groups of farmers. This created awareness of the technology through oral means, brochures, demonstration plots, drama/ sketches.
Gender concern in the development and dissemination of the technology	Women can easily practice CA technology that is known not to be labour intensive.

Additional important information about the technology	None
Contact details of the generators and promotors of the technology	Ivy Ligowe, Chitedze Agriculture Research Institute. Department of Agricultural Research, Email address: ivyligowe@gmail.com. Mobile: +265 999 267 809, Country: Malawi Mathias Tembo, Zambia Agriculture Research Institute. Email address: mathiastembo2002@yahoo.com, Telephone: +260 211 278130 Mobile: +260 966 957408, ountry: Zambia Antonio Chamuene, IIAM, Email address: chamuene@gmail.com Mobile: +258 849082811 / +258 828664140 Country: Mozambique

1.5 Early and medium maturing maize varieties tolerant to multiple diseases

1.5.1 Maize variety - Tsangano

Title of the technology or innovation	Improved maize variety tolerant to MSV, leaf blight and downy mildew diseases – Tsangano
Description of the technology	Tsangano is an improved maize variety which is resistant to MSV, Helmitosporiose Exserohilum turcicum and **Perenosclerospora sorghi.** It produces 3-8 tons ha^{-1} and matures in between 127-140 days.
End users of the technology	The users of the technology are smallholder farmers in three different agro-ecological zones of Malawi, millers, researchers and extension staff.
Critical and essential factors for successful promotion and adoption of the technology	It is critical and essential to strengthen research-extension linkages in order to enhance collaboration, utilization and scaling-up of the technology. Availability and accessibility of improved seed, scaling-up of on-farm demonstrations and availing markets for the technology are also paramount for technology promotion and adoption.
Challenges encountered in respect to further dissemination of the technology, adoption and up/out scaling	Inadequate knowledge on the identification of diseases and pests in CA maize production cropping system amongst farmers, conflicting messages from different CA players on the appropriate CA technology packages, competing uses of maize stover, insufficient seed supply and low capacity of extension officers in sensitization of the technology were amongst the challenges encountered during the testing and dissemination of the technology.
Recommendations for addressing the challenges listed above	There is a need to (i) train farmers and extension workers on the identification and control measures of pests and diseases in CA cropping systems; (ii) harmonize information on the CA technology package; (iii) identify alternative materials for use in covering the soil in CA other than reliance on maize crop residues only.
Lessons learnt on the best ways for addressing the challenges listed above	Involvement of farmers, extension officers and all existing NGOs in the community is key towards popularizing the technologies. Farmer to farmer extension, regular trainings of farmers and farmer exchange visits promote technology dissemination. It was also noted that demonstrations are effective in disseminating the technology to wider groups of farmers. This created awareness of the technology through oral means, brochures, demonstration plots, drama/ sketches.

Gender concern in the developmentanddissemination of the technology	Women can easily practice CA technology that is known not to be labour intensive.
Additional important information about the technology	None
Contact details of the generators and promotors of the technology	Ivy Ligowe, Chitedze Agriculture Research Institute. Department of Agricultural Research, Email address: ivyligowe@gmail.com. Mobile: +265 999 267 809, Country: Malawi Mathias Tembo, Zambia Agriculture Research Institute. Email address: mathiastembo2002@yahoo.com, Telephone: +260 211 278130 Mobile: +260 966 957408, ountry: Zambia Antonio Chamuene, IIAM, Email address: chamuene@gmail.com Mobile: +258 849082811 / +258 828664140 Country: Mozambique

1.5.2 Maize variety - MH 26

Title of the technology or innovation	Medium maturing maize variety tolerant to GLS, TLB and MSV diseases - MH 26
Description of the technology	MH26 is medium maturing variety (130-133 days), adapted to a wide range of environments in Malawi. It has the potential yield of 10,000 kg/ha and resistant to lodging. It also tolerates multiple diseases such as GLS, TLB and MSV. 
End users of the technology	The users of the technology are smallholder farmers in three different agro-ecological, millers, researchers and extension staff.

Critical and essential factors for successful promotion and adoption of the technology	Strengthening of the research-extension linkages is key to enhancing collaboration, utilization and scaling-up of the technology. In addition, availability of and accessibility to improved seed form the basis for technology uptake. Finally, scaling-up of on-farm demonstrations and facilitating the availability of ready markets are also essential for the promotion and adoption of the technologies.
Challenges encountered in respect to further dissemination of the technology, adoption and up/out scaling	Farmers' inadequate knowledge on the identification of diseases and pests in conservation agriculture (CA) maize production cropping system, conflicting messages from different CA players on the appropriate CA technology packages, competing uses of maize stover were the most common challenges encountered during dissemination of the technology. Low capacity of extension officers in sensitization of the technology also contributed to the slowing down of the dissemination initiatives.
Recommendations for addressing the challenges listed above	There is a need to train farmers and extension workers on the identification and control of pests and diseases in CA cropping systems. There is also a need to harmonize information on the CA technology package. Finally, alternative uses of soil cover in CA other than reliance on maize crop residues needs to be explored.
Lessons learnt on the best ways for addressing the challenges listed above	Involvement of farmers, extension officers and all existing NGOs in the community is key towards popularizing the technologies. Farmer to farmer extension, regular trainings of farmers and farmer exchange visits promote technology dissemination. It was also noted that demonstrations are effective in disseminating the technology to wider groups of farmers. This created awareness of the technology through oral means, brochures, demonstration plots, drama/sketches.
Gender concern in the development and dissemination of the technology	Women can easily practice CA technology that is known not to be labour intensive.
Additional important information about the technology	None

Contact details of the generators and promotors of the technology	Ivy Ligowe, Chitedze Agriculture Research Institute. Department of Agricultural Research, Email address: ivyligowe@gmail.com. Mobile: +265 999 267 809, Country: Malawi Mathias Tembo, Zambia Agriculture Research Institute. Email address: mathiastembo2002@yahoo.com, Telephone: +260 211 278130 Mobile: +260 966 957408, country: Zambia Antonio Chamuene, IIAM, Email address: chamuene@gmail.com Mobile: +258 849082811 / +258 828664140 Country: Mozambique

1.5.3 Maize variety - SC 627

Title of the technology or innovation	Medium maturing maize variety, tolerant to MSV and GLS- SC 627
Description of the technology	SC627 is a medium maturing maize variety (144 days) with good levels of tolerance to maize streak virus (MSV) and grey leaf spot (GLS) diseases. The yield range is between 5,000 and 10,000 kg/ha depending on management practices. It is suitable for production in a wide range of environments in Malawi, and particularly for winter cultivation under both irrigated and residual soil moisture.
End users of the technology	The users of the technology are smallholder farmers in three different agro-ecological zones of Malawi, millers, researchers and extension staff.
Critical and essential factors for successful promotion and adoption of the technology	It is critical and essential to strengthen research-extension linkages in order to enhance collaboration, utilization and scaling-up of the technology. Availability and accessibility of improved seed, scaling-up of on-farm demonstrations and availing markets for the technology are also paramount for technology promotion and adoption.
Challenges encountered in respect to further dissemination of the technology, adoption and up/out scaling	Inadequate knowledge on the identification of diseases and pests in CA maize production cropping system amongst farmers, conflicting messages from different CA players on the appropriate CA technology packages, competing uses of maize stover, insufficient seed supply and low capacity of extension officers in sensitization of the technology were amongst the challenges encountered during the testing and dissemination of the technology.

Recommendations for addressing the challenges listed above	There is a need to (i) train farmers and extension workers on the identification and control measures of pests and diseases in CA cropping systems; (ii) harmonize information on the CA technology package; (iii) identify alternative materials for use in covering the soil in CA other than reliance on maize crop residues only.
Lessons learnt on the best ways for addressing the challenges listed above	Involvement of farmers, extension officers and all existing NGOs in the community is key towards popularizing the technologies. Farmer to farmer extension, regular trainings of farmers and farmer exchange visits promote technology dissemination. It was also noted that demonstrations are effective in disseminating the technology to wider groups of farmers. This created awareness of the technology through oral means, brochures, demonstration plots, drama/sketches.
Gender concern in the developmentanddissemination of the technology	Women can easily practice CA technology that is known not to be labour intensive.
Additional important information about the technology	None
Contact details of the generators and promotors of the technology	Ivy Ligowe, Chitedze Agriculture Research Institute. Department of Agricultural Research, Email address: ivyligowe@gmail.com. Mobile: +265 999 267 809, Country: Malawi Mathias Tembo, Zambia Agriculture Research Institute. Email address: mathiastembo2002@yahoo.com, Telephone: +260 211 278130 Mobile: +260 966 957408, country: Zambia Antonio Chamuene, IIAM, Email address: chamuene@gmail.com Mobile: +258 849082811 / +258 828664140 Country: Mozambique

1.5.4 Maize variety - PAN4M-19

Title of the technology or innovation	Medium duration maize variety with some tolerance to GLS and TLB diseases - PAN4M-19

Description of the technology	PAN4M-19 is a medium duration variety (140 days) suitable for the medium altitude areas (500-1,300 masl). The yield potential ranges from 6,000 to 8,000 kg/ha. The variety has low levels of tolerance to GLS and TLB and is susceptible to MSV
End users of the technology	The users of the technology are smallholder farmers in three different agro-ecological zones of Malawi, millers, researchers and extension staff.
Critical and essential factors for successful promotion and adoption of the technology	It is critical and essential to strengthen research-extension linkages in order to enhance collaboration, utilization and scaling-up of the technology. Availability and accessibility of improved seed, scaling-up of on-farm demonstrations and availing markets for the technology are also paramount for technology promotion and adoption.
Challenges encountered in respect to further dissemination of the technology, adoption and up/out scaling	Inadequate knowledge on the identification of diseases and pests in CA maize production cropping system amongst farmers, conflicting messages from different CA players on the appropriate CA technology packages, competing uses of maize stover, insufficient seed supply and low capacity of extension officers in sensitization of the technology were amongst the challenges encountered during the testing and dissemination of the technology.
Recommendations for addressing the challenges listed above	There is a need to (i) train farmers and extension workers on the identification and control measures of pests and diseases in CA cropping systems; (ii) harmonize information on the CA technology package; (iii) identify alternative materials for use in covering the soil in CA other than reliance on maize crop residues only.
Lessons learnt on the best ways for addressing the challenges listed above	Involvement of farmers, extension officers and all existing NGOs in the community is key towards popularizing the technologies. Farmer to farmer extension, regular trainings of farmers and farmer exchange visits promote technology dissemination. It was also noted that demonstrations are effective in disseminating the technology to wider groups of farmers. This created awareness of the technology through oral means, brochures, demonstration plots, drama/sketches.
Gender concern in the development and dissemination of the technology	Women can easily practice CA technology that is known not to be labour intensive.

Additional important information about the technology	None
Contact details of the generators and promotors of the technology	Ivy Ligowe, Chitedze Agriculture Research Institute. Department of Agricultural Research, Email address: ivyligowe@gmail.com. Mobile: +265 999 267 809, Country: Malawi Mathias Tembo, Zambia Agriculture Research Institute. Email address: mathiastembo2002@yahoo.com, Telephone: +260 211 278130 Mobile: +260 966 957408, country: Zambia Antonio Chamuene, IIAM, Email address: chamuene@gmail.com Mobile: +258 849082811 / +258 828664140 Country: Mozambique

1.5.5 Maize variety - PHB 2856

Title of the technology or innovation	Early maturing maize variety tolerant to GLS, TLB, LR and cob rot diseases - PHB 2856
Description of the technology	PHB 2856 is an early to medium maturing variety (110-120 days) adapted to medium altitude plateau areas (500-1,300 mass) and its yield potential ranges from 7,000 – 10,000 kg/ha. It is resistant to GLS, TLB, LR and cob rot and has medium resistance to MSV
End users of the technology	The users of the technology are smallholder farmers in three different agro-ecological zones of Malawi, millers, researchers and extension staff.
Critical and essential factors for successful promotion and adoption of the technology	It is critical and essential to strengthen research-extension linkages in order to enhance collaboration, utilization and scaling-up of the technology. Availability and accessibility of improved seed, scaling-up of on-farm demonstrations and availing markets for the technology are also paramount for technology promotion and adoption.
Challenges encountered in respect to further dissemination of the technology, adoption and up/out scaling	Inadequate knowledge on the identification of diseases and pests in CA maize production cropping system amongst farmers, conflicting messages from different CA players on the appropriate CA technology packages, competing uses of maize stover, insufficient seed supply and low capacity of extension officers in sensitization of the technology were amongst the challenges encountered during the testing and dissemination of the technology.

Recommendations for addressing the challenges listed above	There is a need to (i) train farmers and extension workers on the identification and control measures of pests and diseases in CA cropping systems; (ii) harmonize information on the CA technology package; (iii) identify alternative materials for use in covering the soil in CA other than reliance on maize crop residues only.
Lessons learnt on the best ways for addressing the challenges listed above	Involvement of farmers, extension officers and all existing NGOs in the community is key towards popularizing the technologies. Farmer to farmer extension, regular trainings of farmers and farmer exchange visits promote technology dissemination. It was also noted that demonstrations are effective in disseminating the technology to wider groups of farmers. This created awareness of the technology through oral means, brochures, demonstration plots, drama/ sketches.
Gender concern in the development and dissemination of the technology	Women can easily practice CA technology that is known not to be labour intensive.
Additional important information about the technology	None
Contact details of the generators and promotors of the technology	Ivy Ligowe, Chitedze Agriculture Research Institute. Department of Agricultural Research, Email address: ivyligowe@gmail.com. Mobile: +265 999 267 809, Country: Malawi Mathias Tembo, Zambia Agriculture Research Institute. Email address: mathiastembo2002@yahoo.com, Telephone: +260 211 278130 Mobile: +260 966 957408, outcry: Zambia Antonio Chamuene, IIAM, Email address: chamuene@gmail.com Mobile: +258 849082811 / +258 828664140 Country: Mozambique

2.0 TECHNOLOGIES FOR LEGUMES AND LEGUME-BASED SYSTEMS

2.1 Common bean technologies

2.1.1 Adaptable common bean varieties which are resistant to bruchids

2.1.1.1 Chitedze BN1

Title of the technology or innovation	Adaptable bruchid resistant bean variety- Chitedze BN1
Description of the technology	Chitedze BN1 is a high yielding variety (2.1tons/ha), adaptable to Zambian and Malawian environmental conditions and resistant to bruchids. It has a determinate growth habit, starts flowing in 41 days and matures in 90 days. The seed colour is dark maroon. The genotype is slightly susceptible to Common Beans Mosaic Virus.
End users of the technology	The target users of the technology are farmer, traders and consumers.
Critical and essential factors for successful promotion and adoption of the technology	Availability and access to basic seed amongst growers, including farmers is critical to the successful promotion of the variety. On farm demonstrations and field days help to demonstrate the traits of the new variety and as such promote its adoption.
Challenges encountered in respect to further dissemination of the technology, adoption and up/out scaling	Inadequate supply of seed and lack of laboratory equipment to conduct holistic screening for bruchids resistance in bean varieties were the main challenges encountered during technology generation and dissemination.
Recommendations for addressing the challenges listed above	There is a need to increase the availability of seed through seed multiplication during off season and incorporate bruchid resistant bean varieties into advanced breeding trials for possible release of the new varieties in Zambia and Mozambique by the bean breeders. It is also recommended that bruchid resistance research be capacitated with a simple equipment for rearing of bruchids for use in the on-farm demonstrations.
Lessons learnt on the best ways for addressing the challenges listed above	Trials and testing during rainy and dry seasons will help achieve results

Gender concern in the developmentanddissemination of the technology	Demonstrations were set mostly in women headed households in order to enhance promotion and adoption of Bruchid resistance varieties. This is because beans are generally considered as women crops because of the role they play in food security.
Additional important information about the technology	Time of planting was noted to have affected bruchid infestation and damage in storage. The earlier planted beans during rainy season had minimal bruchid infestation and damage as compared to late planted beans.
Contact details of the generators and promotors of the technology	Arsenio Chimphamba, DARS, Malawi. Carvalho C. Ecole, IIAM - FPLM, 2698 Avenue – Maputo; ccecole@gmail.com. Gilson Chipabika, ZARI. Private BAG 7 – Chilanga, Zambia. gilsonchipabika@gmail.com

2.1.1.2 Chitedze BN2

Title of the technology or innovation	Adaptable bruchid resistant bean varieties- Chitedze BN2
Description of the technology	Chitedze BN2 is determinant variety with dark maroon seeds and yields 1.9tons/ha. It takes 42 days to flower and 87 days to mature. The genotype is susceptible to Common Beans Mosaic Virus.
End users of the technology	The target users of the technology are farmer, traders and consumers.
Critical and essential factors for successful promotion and adoption of the technology	Availability and access to basic seed amongst growers, including farmers is critical to the successful promotion of the variety. On farm demonstrations and field days help to demonstrate the traits of the new variety and as such promote its adoption.
Challenges encountered in respect to further dissemination of the technology, adoption and up/out scaling	Inadequate supply of seed and lack of laboratory equipment to conduct holistic screening for bruchids resistance in bean varieties were the main challenges encountered during technology generation and dissemination.

Recommendations for addressing the challenges listed above	There is a need to increase the availability of seed through seed multiplication during off season and incorporate bruchid resistant bean varieties into advanced breeding trials for possible release of the new varieties in Zambia and Mozambique by the bean breeders. It is also recommended that bruchid resistance research be capacitated with a simple equipment for rearing of bruchids for use in the on-farm demonstrations.
Lessons learnt on the best ways for addressing the challenges listed above	Trials and testing during rainy and dry seasons will help achieve results
Gender concern in the development and dissemination of the technology	Demonstrations were set mostly in women headed households in order to enhance promotion and adoption of Bruchid resistance varieties. This is because beans are generally considered as women crops because of the role they play in food security.
Additional important information about the technology	Time of planting was noted to have affected bruchid infestation and damage in storage. The earlier planted beans during rainy season had minimal bruchid infestation and damage as compared to late planted beans.
Contact details of the generators and promotors of the technology	Arsenio Chimphamba, DARS, Malawi. Carvalho C. Ecole, IIAM - FPLM, 2698 Avenue – Maputo; ccecole@gmail.com. Gilson Chipabika, ZARI. Private BAG 7 – Chilanga, Zambia. gilsonchipabika@gmail.com

2.1.1.3 Chitedze BN3

Title of the technology or innovation	Adaptable bruchid resistant bean varieties- Chitedze BN3
Description of the technology	Chitedze BN3 is a determinate variety with the potential yield of 1.3tons/ha and produces dark maroon seeds. It takes 44 days to start flowing and 88dys to reach maturity. The genotype is susceptible to Common Beans Mosaic Virus.
End users of the technology	The target users of the technology are farmer, traders and consumers.

Critical and essential factors for successful promotion and adoption of the technology	Availability and access to basic seed amongst growers, including farmers is critical to the successful promotion of the variety. On farm demonstrations and field days help to demonstrate the traits of the new variety and as such promote its adoption.
Challenges encountered in respect to further dissemination of the technology, adoption and up/out scaling	Inadequate supply of seed and lack of laboratory equipment to conduct holistic screening for bruchids resistance in bean varieties were the main challenges encountered during technology generation and dissemination.
Recommendations for addressing the challenges listed above	There is a need to increase the availability of seed through seed multiplication during off season and incorporate bruchid resistant bean varieties into advanced breeding trials for possible release of the new varieties in Zambia and Mozambique by the bean breeders. It is also recommended that bruchid resistance research be capacitated with a simple equipment for rearing of bruchids for use in the on-farm demonstrations.
Lessons learnt on the best ways for addressing the challenges listed above	Trials and testing during rainy and dry seasons will help achieve results
Gender concern in the development and dissemination of the technology	Demonstrations were set mostly in women headed households in order to enhance promotion and adoption of Bruchid resistance varieties. This is because beans are generally considered as women crops because of the role they play in food security.
Additional important information about the technology	Time of planting was noted to have affected bruchid infestation and damage in storage. The earlier planted beans during rainy season had minimal bruchid infestation and damage as compared to late planted beans.
Contact details of the generators and promotors of the technology	Arsenio Chimphamba, DARS, Malawi. Carvalho C. Ecole, IIAM - FPLM, 2698 Avenue – Maputo; ccecole@gmail.com. Gilson Chipabika, ZARI. Private BAG 7 – Chilanga, Zambia. gilsonchipabika@gmail.com

2.1.1.4 Chitedze BN4

Title of the technology or innovation	Adaptable bruchid resistant bean varieties- Chitedze BN4
Description of the technology	Chitedze BN4 is determinate variety with the potential yield of 1.7tohs/ha and when seeds are mature, they are pinkish. It takes 44 days to flower and 80 days to reach maturity. The genotype is susceptible to Common Beans Mosaic Virus.
End users of the technology	The target users of the technology are farmer, traders and consumers.
Critical and essential factors for successful promotion and adoption of the technology	Availability and access to basic seed amongst growers, including farmers is critical to the successful promotion of the variety. On farm demonstrations and field days help to demonstrate the traits of the new variety and as such promote its adoption.
Challenges encountered in respect to further dissemination of the technology, adoption and up/out scaling	Inadequate supply of seed and lack of laboratory equipment to conduct holistic screening for bruchids resistance in bean varieties were the main challenges encountered during technology generation and dissemination.
Recommendations for addressing the challenges listed above	There is a need to increase the availability of seed through seed multiplication during off season and incorporate bruchid resistant bean varieties into advanced breeding trials for possible release of the new varieties in Zambia and Mozambique by the bean breeders. It is also recommended that bruchid resistance research be capacitated with a simple equipment for rearing of bruchids for use in the on-farm demonstrations.
Lessons learnt on the best ways for addressing the challenges listed above	Trials and testing during rainy and dry seasons will help achieve results
Gender concern in the developmentanddissemination of the technology	Demonstrations were set mostly in women headed households in order to enhance promotion and adoption of Bruchid resistance varieties. This is because beans are generally considered as women crops because of the role they play in food security.
Additional important information about the technology	Time of planting was noted to have affected bruchid infestation and damage in storage. The earlier planted beans during rainy season had minimal bruchid infestation and damage as compared to late planted beans.

Contact details of the generators and promotors of the technology	Arsenio Chimphamba, DARS, Malawi. Carvalho C. Ecole, IIAM - FPLM, 2698 Avenue – Maputo; ccecole@gmail.com. Gilson Chipabika, ZARI. Private BAG 7 – Chilanga, Zambia. gilsonchipabika@gmail.com

2.1.1.5 Chitedze BN5

Title of the technology or innovation	Adaptable bruchid resistant bean varieties- Chitedze BN5
Description of the technology	Chitedze BN5 is indeterminate variety with the potential yield of 1.5tons/ha and produces purplish seed. It takes 32 days to flower and 82 days to reach maturity. The genotype is susceptible to Common Beans Mosaic Virus.
End users of the technology	The target users of the technology are farmer, traders and consumers.
Critical and essential factors for successful promotion and adoption of the technology	Availability and access to basic seed amongst growers, including farmers is critical to the successful promotion of the variety. On farm demonstrations and field days help to demonstrate the traits of the new variety and as such promote its adoption.
Challenges encountered in respect to further dissemination of the technology, adoption and up/out scaling	Inadequate supply of seed and lack of laboratory equipment to conduct holistic screening for bruchids resistance in bean varieties were the main challenges encountered during technology generation and dissemination.
Recommendations for addressing the challenges listed above	There is a need to increase the availability of seed through seed multiplication during off season and incorporate bruchid resistant bean varieties into advanced breeding trials for possible release of the new varieties in Zambia and Mozambique by the bean breeders. It is also recommended that bruchid resistance research be capacitated with a simple equipment for rearing of bruchids for use in the on-farm demonstrations.
Lessons learnt on the best ways for addressing the challenges listed above	Trials and testing during rainy and dry seasons will help achieve results

Gender concern in the developmentanddissemination of the technology	Demonstrations were set mostly in women headed households in order to enhance promotion and adoption of Bruchid resistance varieties. This is because beans are generally considered as women crops because of the role they play in food security.
Additional important information about the technology	Time of planting was noted to have affected bruchid infestation and damage in storage. The earlier planted beans during rainy season had minimal bruchid infestation and damage as compared to late planted beans.
Contact details of the generators and promotors of the technology	Arsenio Chimphamba, DARS, Malawi. Carvalho C. Ecole, IIAM - FPLM, 2698 Avenue – Maputo; ccecole@gmail.com. Gilson Chipabika, ZARI. Private BAG 7 – Chilanga, Zambia. gilsonchipabika@gmail.com

2.1.1.6 Mnyambitila

Title of the technology or innovation	Adaptable bruchid resistant bean varieties- Mnyambitila
Description of the technology	Nyambitira is a tasty bean variety with determinate growth habit and yields 2.2tons/ha. The seed color is dark maroon. It takes 43 to flower and 90 days to mature. The genotype is susceptible to Common Beans Mosaic Virus.
End users of the technology	The target users of the technology are farmer, traders and consumers.
Critical and essential factors for successful promotion and adoption of the technology	Availability and access to basic seed amongst growers, including farmers is critical to the successful promotion of the variety. On farm demonstrations and field days help to demonstrate the traits of the new variety and as such promote its adoption.
Challenges encountered in respect to further dissemination of the technology, adoption and up/out scaling	Inadequate supply of seed and lack of laboratory equipment to conduct holistic screening for bruchids resistance in bean varieties were the main challenges encountered during technology generation and dissemination.

Recommendations for addressing the challenges listed above	There is a need to increase the availability of seed through seed multiplication during off season and incorporate bruchid resistant bean varieties into advanced breeding trials for possible release of the new varieties in Zambia and Mozambique by the bean breeders. It is also recommended that bruchid resistance research be capacitated with a simple equipment for rearing of bruchids for use in the on-farm demonstrations.
Lessons learnt on the best ways for addressing the challenges listed above	Trials and testing during rainy and dry seasons will help achieve results
Gender concern in the developmentanddissemination of the technology	Demonstrations were set mostly in women headed households in order to enhance promotion and adoption of Bruchid resistance varieties. This is because beans are generally considered as women crops because of the role they play in food security.
Additional important information about the technology	Time of planting was noted to have affected bruchid infestation and damage in storage. The earlier planted beans during rainy season had minimal bruchid infestation and damage as compared to late planted beans.
Contact details of the generators and promotors of the technology	Arsenio Chimphamba, DARS, Malawi. Carvalho C. Ecole, IIAM - FPLM, 2698 Avenue – Maputo; ccecole@gmail.com. Gilson Chipabika, ZARI. Private BAG 7 – Chilanga, Zambia. gilsonchipabika@gmail.com

2.1.1.7 Namtupa

Title of the technology or innovation	Adaptable bruchid resistant bean varieties- Namtupa
Description of the technology	Namtupa is determinate variety with dark maroon seeds and yield potential of 1.8tons/ha. It starts flowering in 44days and matures within 91 days. The genotype is susceptible to common Beans Mosaic Virus.
End users of the technology	The target users of the technology are farmer, traders and consumers.

Critical and essential factors for successful promotion and adoption of the technology	Availability and access to basic seed amongst growers, including farmers is critical to the successful promotion of the variety. On farm demonstrations and field days help to demonstrate the traits of the new variety and as such promote its adoption.
Challenges encountered in respect to further dissemination of the technology, adoption and up/out scaling	Inadequate supply of seed and lack of laboratory equipment to conduct holistic screening for bruchids resistance in bean varieties were the main challenges encountered during technology generation and dissemination.
Recommendations for addressing the challenges listed above	There is a need to increase the availability of seed through seed multiplication during off season and incorporate bruchid resistant bean varieties into advanced breeding trials for possible release of the new varieties in Zambia and Mozambique by the bean breeders. It is also recommended that bruchid resistance research be capacitated with a simple equipment for rearing of bruchids for use in the on-farm demonstrations.
Lessons learnt on the best ways for addressing the challenges listed above	Trials and testing during rainy and dry seasons will help achieve results
Gender concern in the development and dissemination of the technology	Demonstrations were set mostly in women headed households in order to enhance promotion and adoption of Bruchid resistance varieties. This is because beans are generally considered as women crops because of the role they play in food security.
Additional important information about the technology	Time of planting was noted to have affected bruchid infestation and damage in storage. The earlier planted beans during rainy season had minimal bruchid infestation and damage as compared to late planted beans.
Contact details of the generators and promotors of the technology	Arsenio Chimphamba, DARS, Malawi. Carvalho C. Ecole, IIAM - FPLM, 2698 Avenue – Maputo; ccecole@gmail.com. Gilson Chipabika, ZARI. Private BAG 7 – Chilanga, Zambia. gilsonchipabika@gmail.com

2.1 2 Bean varieties tolerant to drought, Common bacterial blight, Bean Common Mosaic Virus and Angular leaf spot

2.1.2.1 G738 (Chitedze Bean 14)

Title of the technology or innovation	Red kidney market class bean variety tolerant to drought, CBB, BCMV and ALS: G738 (Chitedze Bean 14)
Description of the technology	G738 is a bush bean variety belonging to red kidney market class, with the potential yield of 2.5 MT/ha. It starts flowering in 36days after planting and matures in 75days after planting.
End users of the technology	The users of the technologies are small-scale farmers, seed companies, processors, grain traders.
Critical and essential factors for successful promotion and adoption of the technology	Seeds availability and accessibility are amongst the critical factors for the successful promotion and adoption of the variety. This requires seed multipliers to avail the seed, and leader farmers and extension staff to demonstrate the performance of the variety. As there is a need to build capacity of key stakeholders involved in the promotion and utilization of the variety.
Challenges encountered in respect to further dissemination of the technology, adoption and up/out scaling	Bean, like most other legumes, are self-pollinating as such can be grown for more than one season without changing the seed. Although this is an advantage, farmers tend to over recycle and consequently do not realize the yield potential. This leads to low demand of bean seed on the market hence affecting the rate of uptake of the technology. Another challenge is the misconception that farmers have, that bean do not require fertilizer.
Recommendations for addressing the challenges listed above	Extensive demonstrations and strengthening research-extension-farmer linkages.
Lessons learnt on the best ways for addressing the challenges listed above	Disseminating the technology by doing enhances the update. Leader farmers play a critical role in disseminating the technologies and its easier for follower farmers to adopt when they see from fellow farmer
Gender concern in the development and dissemination of the technology	Bean are considered a women crop, as such the technology benefited more women than men.

Additional important information about the technology	None
Contact details of the generators and promotors of the technology	Virginia Chisale, Chitedze Research Station vchisale@yahoo.com viginia.chisale@dars.mw

2.1.2.2 G1939 (Chitedze Bean 15)

Title of the technology or innovation	High yielding sugar market class bean variety, tolerant to CBB, BCMV and ALS: G1939 (Chitedze Bean 15)
Description of the technology	G1939 is bush variety belonging to sugar market class and has a potential yield of 2.7 MT/ha. It flowers in 43 and matures in 80. The variety is tolerant to drought, CBB, BCMV and ALS
End users of the technology	The users of the technologies are small-scale farmers, seed companies, processors, grain traders.
Critical and essential factors for successful promotion and adoption of the technology	Seeds availability and accessibility are amongst the critical factors for the successful promotion and adoption of the variety. This requires seed multipliers to avail the seed, and leader farmers and extension staff to demonstrate the performance of the variety. As there is a need to build capacity of key stakeholders involved in the promotion and utilization of the variety.
Challenges encountered in respect to further dissemination of the technology, adoption and up/out scaling	Bean, like most other legumes, are self-pollinating as such can be grown for more than one season without changing the seed. Although this is an advantage, farmers tend to over recycle and consequently do not realize the yield potential. This leads to low demand of bean seed on the market hence affecting the rate of uptake of the technology. Another challenge is the misconception that farmers have, that bean do not require fertilizer.
Recommendations for addressing the challenges listed above	Extensive demonstrations and strengthening research-extension-farmer linkages.
Lessons learnt on the best ways for addressing the challenges listed above	Disseminating the technology by doing enhances the update. Leader farmers play a critical role in disseminating the technologies and its easier for follower farmers to adopt when they see from fellow farmer

Gender concern in the development and dissemination of the technology	Bean are considered a women crop, as such the technology benefited more women than men.
Additional important information about the technology	None
Contact details of the generators and promotors of the technology	Virginia Chisale, Chitedze Research Station vchisale@yahoo.com viginia.chisale@dars.mw

2.1.2.3 G11982 (Chitedze Bean 16)

Title of the technology or innovation	High yielding sugar bean variety tolerant to CBB, BCMV and ALS: G11982 (Chitedze Bean 16)
Description of the technology	G11982 is bush variety belonging to sugar market class and has a potential yield of 2.5 MT/ha. It flowers in 43 and matures in 80. The variety is tolerant to drought, CBB, BCMV and ALS
End users of the technology	The users of the technologies are small-scale farmers, seed companies, processors, grain traders.
Critical and essential factors for successful promotion and adoption of the technology	Seeds availability and accessibility are amongst the critical factors for the successful promotion and adoption of the variety. This requires seed multipliers to avail the seed, and leader farmers and extension staff to demonstrate the performance of the variety. As there is a need to build capacity of key stakeholders involved in the promotion and utilization of the variety.
Challenges encountered in respect to further dissemination of the technology, adoption and up/out scaling	Bean, like most other legumes, are self-pollinating as such can be grown for more than one season without changing the seed. Although this is an advantage, farmers tend to over recycle and consequently do not realize the yield potential. This leads to low demand of bean seed on the market hence affecting the rate of uptake of the technology. Another challenge is the misconception that farmers have, that bean do not require fertilizer.
Recommendations for addressing the challenges listed above	Extensive demonstrations and strengthening research-extension-farmer linkages.

Lessons learnt on the best ways for addressing the challenges listed above	Disseminating the technology by doing enhances the update. Leader farmers play a critical role in disseminating the technologies and its easier for follower farmers to adopt when they see from fellow farmer
Gender concern in the development and dissemination of the technology	Bean are considered a women crop, as such the technology benefited more women than men.
Additional important information about the technology	None
Contact details of the generators and promotors of the technology	Virginia Chisale, Chitedze Research Station vchisale@yahoo.com viginia.chisale@dars.mw

2.1.2.4 SAA20 (Chitedze Bean 17)

Title of the technology or innovation	Large white bean variety tolerant to CBB, BCMV and ALS: SAA20 (Chitedze Bean 17)
Description of the technology	SAA20 is a high yielding bush bean belonging to a market class of large white with the potential yield of 2.5MT/ha. It is tolerant to drought tolerant to drought, CBB, BCMV and ALS. It flowers in 36 days and matures in 75days
End users of the technology	The users of the technologies are small-scale farmers, seed companies, processors, grain traders.
Critical and essential factors for successful promotion and adoption of the technology	Seeds availability and accessibility are amongst the critical factors for the successful promotion and adoption of the variety. This requires seed multipliers to avail the seed, and leader farmers and extension staff to demonstrate the performance of the variety. As there is a need to build capacity of key stakeholders involved in the promotion and utilization of the variety.
Challenges encountered in respect to further dissemination of the technology, adoption and up/out scaling	Bean, like most other legumes, are self-pollinating as such can be grown for more than one season without changing the seed. Although this is an advantage, farmers tend to over recycle and consequently do not realize the yield potential. This leads to low demand of bean seed on the market hence affecting the rate of uptake of the technology. Another challenge is the misconception that farmers have, that bean do not require fertilizer.

Recommendations for addressing the challenges listed above	Extensive demonstrations and strengthening research-extension-farmer linkages.
Lessons learnt on the best ways for addressing the challenges listed above	Disseminating the technology by doing enhances the update. Leader farmers play a critical role in disseminating the technologies and its easier for follower farmers to adopt when they see from fellow farmer
Gender concern in the development and dissemination of the technology	Bean are considered a women crop, as such the technology benefited more women than men.
Additional important information about the technology	None
Contact details of the generators and promotors of the technology	Virginia Chisale, Chitedze Research Station vchisale@yahoo.com viginia.chisale@dars.mw

2.1.3 Improved common bean market classes

2.1.3.1 Black seeded bean variety: ICA PIJAO

Title of the technology or innovation	High yielding bean variety: ICA PIJAO
Description of the technology	ICA PIJAOis a . high yielding and median seeded variety belonging to the market class with black colour. It is an early to medium maturing variety (110 days to maturity) with a yield potential of 2.5tons/ha and potential to escape terminal drought.
End users of the technology	The end-users of the variety are commercial and smallholder farmers .

Critical and essential factors for successful promotion and adoption of the technology	Seeds availability and accessibility through seed multipliers such as Public and Private Seed Companies, Farmer Groups and Farmer Research Networks are essential for the adoption of the variety. Good market for technology product (good quality price), existence of strong farmers' organizations; availability of credit support through farmers' groups/cooperatives and availability of extension services (public and private) are also amongst the critical and essential factors for the promotion and adoption of the variety.
Challenges encountered in respect to further dissemination of the technology, adoption and up/out scaling	Insufficient seed supply due to low levels of seed multiplication and low capacity of extension officers slowed down dissemination and consequent adoption of the variety. For instance, well capacitated extension workers are critical in supporting the establishment and management of demonstration plots. In addition, there was weak commitment amongst the private seed companies in producing legume seeds. This was because legumes are self-pollinating hence easier to maintain relatively high-quality seed for the next planting season by the farmers without going back to the seed company for new seeds.
Recommendations for addressing the challenges listed above	Extension officers are crucial stakeholders in dissemination/ scaling up of the technology. They should demonstrate technologies to farmers through Farmer Field Schools (FFS), Farmer Field Days (FFDs) and agricultural shows. Furthermore, farmers should be sensitized on the benefits of using improved technologies. Engagement of farmers groups producing seed for local commercialization is also recommended while extension officers need to be engagement in promotional campaigns. There is also a need to devise ways of availing credit for access to agricultural inputs by the farmers. This is expected to encourage the farmers to invest in quality seeds.
Lessons learnt on the best ways for addressing the challenges listed above	Creating awareness of the technology through oral means, brochures, demonstration as well as farmer to farmer extension plots can improve technology uptake. Finally, regular training of farmers and farmer exchange visits are important in technology dissemination
Gender concern in the development and dissemination of the technology	Ica Pijao, a black seeded variety is more preferred by men because of its high value for commercialization.
Additional important information about the technology	None

Contact details of the generators and promotors of the technology	IIAM Email address: mivamane@gmail.com Telephone: Mobile: Country: Mozambique

2.1.3.2 Calima bean Variety: BONUS

Title of the technology or innovation	Calima type bean Variety: BONUS
Description of the technology	Bonus is median to late maturity variety which takes between 120 and 130 days to maturity.
End users of the technology	The end-users of the variety are commercial and smallholder farmers in Mozambique and in the region
Critical and essential factors for successful promotion and adoption of the technology	Seeds availability and accessibility through seed multipliers such as Public and Private Seed Companies, Farmer Groups and Farmer Research Networks are essential for the adoption of the variety. Good market for technology product (good quality price), existence of strong farmers' organizations; availability of credit support through farmers' groups/cooperatives and availability of extension services (public and private) are also amongst the critical and essential factors for the promotion and adoption of the variety.
Challenges encountered in respect to further dissemination of the technology, adoption and up/out scaling	Insufficient seed supply due to low levels of seed multiplication and low capacity of extension officers slowed down dissemination and consequent adoption of the variety. For instance, well capacitated extension workers are critical in supporting the establishment and management of demonstration plots. In addition, there was weak commitment amongst the private seed companies in producing legume seeds. This was because legumes are self-pollinating hence easier to maintain relatively high-quality seed for the next planting season by the farmers without going back to the seed company for new seeds.

Recommendations for addressing the challenges listed above	Extension officers are crucial stakeholders in dissemination/ scaling up of the technology. They should demonstrate technologies to farmers through Farmer Field Schools (FFS), Farmer Field Days (FFDs) and agricultural shows. Furthermore, farmers should be sensitized on the benefits of using improved technologies. Engagement of farmers groups producing seed for local commercialization is also recommended while extension officers need to be engagement in promotional campaigns. There is also a need to devise ways of availing credit for access to agricultural inputs by the farmers. This is expected to encourage the farmers to invest in quality seeds.
Lessons learnt on the best ways for addressing the challenges listed above	Creating awareness of the technology through oral means, brochures, demonstration as well as farmer to farmer extension plots can improve technology uptake. Finally, regular training of farmers and farmer exchange visits are important in technology dissemination
Gender concern in the developmentanddissemination of the technology	Bonus is preferred by women because of its role in household food security.
Additional important information about the technology	None
Contact details of the generators and promotors of the technology	IIAM Email address: mivamane@gmail.com Telephone: Mobile: Country: Mozambique

2.1.3.3. Sugar bean variety: VTTT 924/2-4-2-1

Title of the technology or innovation	High yielding sugar market class bean Variety: VTTT 924/2-4-2-1
Description of the technology	VTTT 924/2-4-2-1 is a determinate dwarf variety with a vine. It belongs to the sugar type market class. The variety is resistant to rust, angular leaf spot (ALS), common bacterial blight (CBB) and anthracnose. The variety has yield potential of 3.0 tons per hectare, matures in 80 days, has very good taste, and cooks in less than 2 hour. It is recommended for all zones with rainfall above 600 mm per annum. The variety is high yielding with a yields potential of 2 - 2.5 T/ha and has some tolerance to drought.

End users of the technology	The end users are smallholder farmers (particularly women) and medium level farmers in Central and Northern zones of Mozambique, Other end-users are millers and extension agents.
Critical and essential factors for successful promotion and adoption of the technology	Seeds availability and accessibility through seed multipliers has been effective such as USEBA, Farmers Associations and private farmer. It is also demanded highly on the market. Adequate trainings for program farmers on business; availability of credit support through farmers' groups/ cooperatives and strong linkages with partners such as FAO are also essential for promotion.
Challenges encountered in respect to further dissemination of the technology, adoption and up/out scaling	Several challenges were encountered during the dissemination and these included the refining of messages for further promotion, limited resources for partners to be involved in the dissemination of VTTT 924/2-4-2-1 and insufficient seed.
Recommendations for addressing the challenges listed above	There is a need to make sure that enough seed of VTTT 924/2-4-2-1 is produced at the right time. In addition, active linkages with regional researchers need to be strengthened.
Lessons learnt on the best ways for addressing the challenges listed above	Confidence in participatory variety selection created strong awareness, through oral means, brochures and demonstration plots. Farmer to farmer extension through the Lead approach proved effective and should be encouraged. Intensifying farmer to farmer exchange visits was another strategy which was effective in facilitating dissemination and adoption of the technology.
Gender concern in the developmentanddissemination of the technology	The shorter cooking time of the variety is appreciated by women and the high marketability and yield is appreciated both by men and women.
Additional important information about the technology	The variety is tolerant to low soil fertility
Contact details of the generators and promotors of the technology	IIAM, Email address: mivamane@gmail.com. Telephone: +25821460190 Mobile: +258823038760 Country: Mozambique

2.1.3.4 Large tan bean variety-Lukupa

Title of the technology or innovation	Improved large seeded beans variety-Lukupa
Description of the technology	Lukupa is a non-climber, Seed colour: tan, Large seed size, 78-80 days to maturity, Potential yield: 1500kg/ha  Figure 9: Seed colour of Lukupa bean variety
End users of the technology	The users of the technologies are small-scale farmers as per recommended regions. Other users include seed companies, processors, grain traders. These varieties are used for direct human consumption, the animal feed industry and confectionary industry
Critical and essential factors for successful promotion and adoption of the technology	Seeds availability, accessibility and affordability by smallholder farmers are critical factors for the promotion and adoption of the technology. Seed can be made available through supporting seed multipliers who include large- and small-scale producers. Capacity of extension staff to sensitize farmers on the profitability of the crop and other nutritional benefits is also critical. Another factor is the availability of credit support through farmers' groups/ cooperatives, and availability of extension services (public and private). In addition, the correct use of an appropriate delivery mechanism such as the dissemination through the private sector, NGOs, and government extension service are also paramount to enhancing adoption. Finally, decentralization of seed certification services (licensing of seed inspectors/samplers and laboratories) will also enable efficiency in the system.
Challenges encountered in respect to further dissemination of the technology, adoption and up/out scaling	Inadequate basic seed, drought occurrence, poor quality of extension messages, inadequate communication between various stakeholders, recycling of seed and negative mind set and attitudes of the key players (farmers and service providers) were the main challenges encountered during technology generation and dissemination.

Recommendations for addressing the challenges listed above	There is a need to support production of basic seed and make it available for use amongst the end-users, It is also necessary to avail irrigation facilities and engage contract farmers to be producing basic seed. Production of basic seed should be promoted together with intensified promotional activities to motivate farmers to be using good quality seed. This entails the need for improving on communication channels through establishing innovation platforms for information sharing, packaging of appropriate extension messages to the users and use of appropriate channels. Creation of strong linkages and partnerships in the seed value chain is also necessary.
Lessons learnt on the best ways for addressing the challenges listed above	One of the lessons is on the need to ensure forward planning of the activities. This minimized the anticipated problems because mitigation measures are put in place. Creating awareness of the technology through oral means, brochures, demonstration plots and using innovation platforms can improve technology uptake. Use of lead farmers to encourage farmer to farmer extension and regular training of farmers are also important in technology dissemination.
Gender concern in the developmentanddissemination of the technology	Gender consideration in terms of labour required in the production of legumes and who benefits needs to be addressed. It is important that social barriers to both gender groups accessing these technologies be addressed.
Additional important information about the technology	The technologies are promoted to raise farmers' incomes through seed sales to the direct beneficiaries. However, the technologies have many other benefits to the consumers in improving their nutritional status.
Contact details of the generators and promotors of the technology	Seed Control and Certification Institute, P.O. Box 350199, Chilanga. Email address: nathpzm@yahoo.co.uk/ natanphiri@gmail.com, Telephone: +260 211 278236, Mobile: +260 973500965 /+260964867043, Country: Zambia Zambia Agriculture Research Institute, P/Bag 7, Chilanga Email address: zaridirector@zari.gov.zm or mwalemp@ yahoo.com, Telephone: +260 211 278130 Mobile: +260 966 766395, Country: Zambia

2.1.3.5 Grey mottled bean variety- Kabulangeti

Title of the technology or innovation	Improved grey mottled and large seeded beans Variety- Kabulangeti
Description of the technology	Kabulangeti is a climber, Seed colour: Grey mottled, Large seed size and takes 80-100 days to maturity with a yield potential of 1000kg/ha
End users of the technology	The users of the technologies are small-scale farmers as per recommended regions. Other users include seed companies, processors and grain traders. These varieties are used for direct human consumption, the animal feed industry and confectionary industry
Critical and essential factors for successful promotion and adoption of the technology	Seeds availability, accessibility and affordability by smallholder farmers are critical factors for the promotion and adoption of the technology. Seed can be made available through supporting seed multipliers who include large- and small-scale producers. Capacity of extension staff to sensitize farmers on the profitability of the crop and other nutritional benefits is also critical. Another factor is the availability of credit support through farmers' groups/ cooperatives, and availability of extension services (public and private). In addition, the correct use of an appropriate delivery mechanism such as the dissemination through the private sector, NGOs, and government extension service are also paramount to enhancing adoption. Finally, decentralization of seed certification services (licensing of seed inspectors/samplers and laboratories) will also enable efficiency in the system.

Figure 10: Kabulangeti bean variety

Challenges encountered in respect to further dissemination of the technology, adoption and up/out scaling	Inadequate basic seed, drought occurrence, poor quality of extension messages, inadequate communication between various stakeholders, recycling of seed and negative mind set and attitudes of the key players (farmers and service providers) were the main challenges encountered during technology generation and dissemination.
Recommendations for addressing the challenges listed above	There is a need to support production of basic seed and make it available for use amongst the end-users, It is also necessary to avail irrigation facilities and engage contract farmers to be producing basic seed. Production of basic seed should be promoted together with intensified promotional activities to motivate farmers to be using good quality seed. This entails the need for improving on communication channels through establishing innovation platforms for information sharing, packaging of appropriate extension messages to the users and use of appropriate channels. Creation of strong linkages and partnerships in the seed value chain is also necessary.
Lessons learnt on the best ways for addressing the challenges listed above	One of the lessons is on the need to ensure forward planning of the activities. This minimized the anticipated problems because mitigation measures are put in place. Creating awareness of the technology through oral means, brochures, demonstration plots and using innovation platforms can improve technology uptake. Use of lead farmers to encourage farmer to farmer extension and regular training of farmers are also important in technology dissemination.
Gender concern in the development and dissemination of the technology	Gender consideration in terms of labour required in the production of legumes and who benefits needs to be addressed. It is important that social barriers to both gender groups accessing these technologies be addressed.
Additional important information about the technology	The technologies are promoted to raise farmers' incomes through seed sales to the direct beneficiaries. However, the technologies have many other benefits to the consumers in improving their nutritional status.
Contact details of the generators and promotors of the technology	Seed Control and Certification Institute, P.O. Box 350199, Chilanga. Email address: nathpzm@yahoo.co.uk/ natanphiri@gmail.com, Telephone: +260 211 278236 , Mobile: +260 973500965/+260964867043, Country: Zambia Zambia Agriculture Research Institute, P/Bag 7, Chilanga, Email address: zaridirector@zari.gov.zm or mwalemp@ yahoo.com,Telephone: +260 211 278130, Mobile: +260 966 766395, Country: Zambia

2.1.3.6 White bean variety- Kalungu

Title of the technology or innovation	Improved white beans Variety-Kalungu
Description of the technology	Kalungu is an improved white beans variety Non-climber, Seed colour: white, Seed size: medium, 78-80 days to maturity, Potential yield: 1000-1500kg/ha  Figure 11: Kalungu bean variety
End users of the technology	The users of the technologies are small-scale farmers as per recommended regions. Other users include seed companies, processors and grain traders. These varieties are used for direct human consumption, the animal feed industry and confectionary industry
Critical and essential factors for successful promotion and adoption of the technology	Seeds availability, accessibility and affordability by smallholder farmers are critical factors for the promotion and adoption of the technology. Seed can be made available through supporting seed multipliers who include large- and small-scale producers. Capacity of extension staff to sensitize farmers on the profitability of the crop and other nutritional benefits is also critical. Another factor is the availability of credit support through farmers' groups/ cooperatives, and availability of extension services (public and private). In addition, the correct use of an appropriate delivery mechanism such as the dissemination through the private sector, NGOs, and government extension service are also paramount to enhancing adoption. Finally, decentralization of seed certification services (licensing of seed inspectors/samplers and laboratories) will also enable efficiency in the system.

Challenges encountered in respect to further dissemination of the technology, adoption and up/out scaling	Inadequate basic seed, drought occurrence, poor quality of extension messages, inadequate communication between various stakeholders, recycling of seed and negative mind set and attitudes of the key players (farmers and service providers) were the main challenges encountered during technology generation and dissemination.
Recommendations for addressing the challenges listed above	There is a need to support production of basic seed and make it available for use amongst the end-users, It is also necessary to avail irrigation facilities and engage contract farmers to be producing basic seed. Production of basic seed should be promoted together with intensified promotional activities to motivate farmers to be using good quality seed. This entails the need for improving on communication channels through establishing innovation platforms for information sharing, packaging of appropriate extension messages to the users and use of appropriate channels. Creation of strong linkages and partnerships in the seed value chain is also necessary.
Lessons learnt on the best ways for addressing the challenges listed above	One of the lessons is on the need to ensure forward planning of the activities. This minimized the anticipated problems because mitigation measures are put in place. Creating awareness of the technology through oral means, brochures, demonstration plots and using innovation platforms can improve technology uptake. Use of lead farmers to encourage farmer to farmer extension and regular training of farmers are also important in technology dissemination.
Gender concern in the development and dissemination of the technology	Gender consideration in terms of labour required in the production of legumes and who benefits needs to be addressed. It is important that social barriers to both gender groups accessing these technologies be addressed.
Additional important information about the technology	The technologies are promoted to raise farmers' incomes through seed sales to the direct beneficiaries. However, the technologies have many other benefits to the consumers in improving their nutritional status.
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2.1.3.7 Brownish beans variety – Chambeshi

Title of the technology or innovation	Improved large seeded beans variety- Chambeshi
Description of the technology	Chambeshi is an Improved large seeded beans variety, non-climber, Seed colour: brownish, Large seed size, 78-80 days to maturity, Potential yield: 1500kg/ha
End users of the technology	The users of the technologies are small-scale farmers as per recommended regions. Other users include seed companies, processors and grain traders. These varieties are used for direct human consumption, the animal feed industry and confectionary industry  Figure 12: Chambeshi bean variety
Critical and essential factors for successful promotion and adoption of the technology	Seeds availability, accessibility and affordability by smallholder farmers are critical factors for the promotion and adoption of the technology. Seed can be made available through supporting seed multipliers who include large- and small-scale producers. Capacity of extension staff to sensitize farmers on the profitability of the crop and other nutritional benefits is also critical. Another factor is the availability of credit support through farmers' groups/ cooperatives, and availability of extension services (public and private). In addition, the correct use of an appropriate delivery mechanism such as the dissemination through the private sector, NGOs, and government extension service are also paramount to enhancing adoption. Finally, decentralization of seed certification services (licensing of seed inspectors/samplers and laboratories) will also enable efficiency in the system.

Challenges encountered in respect to further dissemination of the technology, adoption and up/out scaling	Inadequate basic seed, drought occurrence, poor quality of extension messages, inadequate communication between various stakeholders, recycling of seed and negative mind set and attitudes of the key players (farmers and service providers) were the main challenges encountered during technology generation and dissemination.
Recommendations for addressing the challenges listed above	There is a need to support production of basic seed and make it available for use amongst the end-users. It is also necessary to avail irrigation facilities and engage contract farmers to be producing basic seed. Production of basic seed should be promoted together with intensified promotional activities to motivate farmers to be using good quality seed. This entails the need for improving on communication channels through establishing innovation platforms for information sharing, packaging of appropriate extension messages to the users and use of appropriate channels. Creation of strong linkages and partnerships in the seed value chain is also necessary.
Lessons learnt on the best ways for addressing the challenges listed above	One of the lessons is on the need to ensure forward planning of the activities. This minimized the anticipated problems because mitigation measures are put in place. Creating awareness of the technology through oral means, brochures, demonstration plots and using innovation platforms can improve technology uptake. Use of lead farmers to encourage farmer to farmer extension and regular training of farmers are also important in technology dissemination.
Gender concern in the development and dissemination of the technology	Gender consideration in terms of labour required in the production of legumes and who benefits needs to be addressed. It is important that social barriers to both gender groups accessing these technologies be addressed.
Additional important information about the technology	The technologies are promoted to raise farmers' incomes through seed sales to the direct beneficiaries. However, the technologies have many other benefits to the consumers in improving their nutritional status.
Contact details of the generators and promotors of the technology	Seed Control and Certification Institute, P.O. Box 350199, Chilanga. Email address: nathpzm@yahoo.co.uk/natanphiri@gmail.com, Telephone: +260 211 278236 Mobile: +260 973500965 /+260964867043 Country: Zambia Zambia Agriculture Research Institute, P/Bag 7, Chilanga, Email address: zaridirector@zari.gov.zm or mwalemp@yahoo.com, Telephone: +260 211 278130 Mobile: +260 966 766395, Country: Zambia

2.1.3.8 Red speckled bean variety- Lyambai

Title of the technology or innovation	Red speckled market class beans variety- Lyambai
Description of the technology	Lyambai is a Red speckled market class beans variety, a non-climber, Seed colour: red speckled, Large seed size, 82-90 days to maturity, Potential yield: 1500kg/ha
End users of the technology	The users of the technologies are small-scale farmers as per recommended regions. Other users include seed companies, processors and grain traders. These varieties are used for direct human consumption, the animal feed industry and confectionary industry  Figure 13: Lyambai bean variety
Critical and essential factors for successful promotion and adoption of the technology	Seeds availability, accessibility and affordability by smallholder farmers are critical factors for the promotion and adoption of the technology. Seed can be made available through supporting seed multipliers who include large- and small-scale producers. Capacity of extension staff to sensitize farmers on the profitability of the crop and other nutritional benefits is also critical. Another factor is the availability of credit support through farmers' groups/ cooperatives, and availability of extension services (public and private). In addition, the correct use of an appropriate delivery mechanism such as the dissemination through the private sector, NGOs, and government extension service are also paramount to enhancing adoption. Finally, decentralization of seed certification services (licensing of seed inspectors/samplers and laboratories) will also enable efficiency in the system.
Challenges encountered in respect to further dissemination of the technology, adoption and up/out scaling	Inadequate basic seed, drought occurrence, poor quality of extension messages, inadequate communication between various stakeholders, recycling of seed and negative mind set and attitudes of the key players (farmers and service providers) were the main challenges encountered during technology generation and dissemination.

Recommendations for addressing the challenges listed above	There is a need to support production of basic seed and make it available for use amongst the end-users, It is also necessary to avail irrigation facilities and engage contract farmers to be producing basic seed. Production of basic seed should be promoted together with intensified promotional activities to motivate farmers to be using good quality seed. This entails the need for improving on communication channels through establishing innovation platforms for information sharing, packaging of appropriate extension messages to the users and use of appropriate channels. Creation of strong linkages and partnerships in the seed value chain is also necessary.
Lessons learnt on the best ways for addressing the challenges listed above	One of the lessons is on the need to ensure forward planning of the activities. This minimized the anticipated problems because mitigation measures are put in place. Creating awareness of the technology through oral means, brochures, demonstration plots and using innovation platforms can improve technology uptake. Use of lead farmers to encourage farmer to farmer extension and regular training of farmers are also important in technology dissemination.
Gender concern in the development and dissemination of the technology	Gender consideration in terms of labour required in the production of legumes and who benefits needs to be addressed. It is important that social barriers to both gender groups accessing these technologies be addressed.
Additional important information about the technology	The technologies are promoted to raise farmers' incomes through seed sales to the direct beneficiaries. However, the technologies have many other benefits to the consumers in improving their nutritional status.
Contact details of the generators and promotors of the technology	Seed Control and Certification Institute, P.O. Box 350199, Chilanga. Email address: nathpzm@yahoo.co.uk/ natanphiri@gmail.com, Telephone: +260 211 278236 Mobile: +260 973500965 /+260964867043 Country: Zambia Zambia Agriculture Research Institute, P/Bag 7, Chilanga, Email address: zaridirector@zari.gov.zm or mwalemp@ yahoo.com, Telephone: +260 211 278130 Mobile: +260 966 766395, Country: Zambia

2.1.3.9 White bean variety- Lwangeni

Title of the technology or innovation	High yielding white beans variety- Lwangeni
Description of the technology	Lwangeni is a white variety with yield potential of 3-4tons/ha. It matures in between 80 to 90 days and suits temperature range of between 17 and 22 °C. It is suitable for regions II and III of Zambia.
End users of the technology	The users of the technologies are small-scale farmers as per recommended regions. Other users include seed companies, processors and grain traders. These varieties are used for direct human consumption, the animal feed industry and confectionary industry
Critical and essential factors for successful promotion and adoption of the technology	Seeds availability, accessibility and affordability by smallholder farmers are critical factors for the promotion and adoption of the technology. Seed can be made available through supporting seed multipliers who include large- and small-scale producers. Capacity of extension staff to sensitize farmers on the profitability of the crop and other nutritional benefits is also critical. Another factor is the availability of credit support through farmers' groups/ cooperatives, and availability of extension services (public and private). In addition, the correct use of an appropriate delivery mechanism such as the dissemination through the private sector, NGOs, and government extension service are also paramount to enhancing adoption. Finally, decentralization of seed certification services (licensing of seed inspectors/samplers and laboratories) will also enable efficiency in the system.
Challenges encountered in respect to further dissemination of the technology, adoption and up/out scaling	Inadequate basic seed, drought occurrence, poor quality of extension messages, inadequate communication between various stakeholders, recycling of seed and negative mind set and attitudes of the key players (farmers and service providers) were the main challenges encountered during technology generation and dissemination.

Recommendations for addressing the challenges listed above	There is a need to support production of basic seed and make it available for use amongst the end-users, It is also necessary to avail irrigation facilities and engage contract farmers to be producing basic seed. Production of basic seed should be promoted together with intensified promotional activities to motivate farmers to be using good quality seed. This entails the need for improving on communication channels through establishing innovation platforms for information sharing, packaging of appropriate extension messages to the users and use of appropriate channels. Creation of strong linkages and partnerships in the seed value chain is also necessary.
Lessons learnt on the best ways for addressing the challenges listed above	One of the lessons is on the need to ensure forward planning of the activities. This minimized the anticipated problems because mitigation measures are put in place. Creating awareness of the technology through oral means, brochures, demonstration plots and using innovation platforms can improve technology uptake. Use of lead farmers to encourage farmer to farmer extension and regular training of farmers are also important in technology dissemination.
Gender concern in the developmentanddissemination of the technology	Gender consideration in terms of labour required in the production of legumes and who benefits needs to be addressed. It is important that social barriers to both gender groups accessing these technologies be addressed.
Additional important information about the technology	The technologies are promoted to raise farmers' incomes through seed sales to the direct beneficiaries. However, the technologies have many other benefits to the consumers in improving their nutritional status.
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2.1.3.10.Red mottled bean variety- Mbereshi

Title of the technology or innovation	Red mottled bean Variety- Mbereshi
Description of the technology	Mbereshi is a red mottled variety with a yield potential of 1.5-2.0 tons/ha. It matures in 80-90 days after planting and suits temperature ranges of 17-22 °C. It grows well in regions II and III of Zambia.
End users of the technology	The users of the technologies are small-scale farmers as per recommended regions. Other users include seed companies, processors, grain traders,. These varieties are used for direct human consumption, the animal feed industry and confectionary industry
Critical and essential factors for successful promotion and adoption of the technology	Seeds availability, accessibility and affordability by smallholder farmers are critical factors for the promotion and adoption of the technology. Seed can be made available through supporting seed multipliers who include large- and small-scale producers. Capacity of extension staff to sensitize farmers on the profitability of the crop and other nutritional benefits is also critical. Another factor is the availability of credit support through farmers' groups/ cooperatives, and availability of extension services (public and private). In addition, the correct use of an appropriate delivery mechanism such as the dissemination through the private sector, NGOs, and government extension service are also paramount to enhancing adoption. Finally, decentralization of seed certification services (licensing of seed inspectors/samplers and laboratories) will also enable efficiency in the system.

Figure 14: Mbereshi common bean variety

Challenges encountered in respect to further dissemination of the technology, adoption and up/out scaling	Inadequate basic seed, drought occurrence, poor quality of extension messages, inadequate communication between various stakeholders, recycling of seed and negative mind set and attitudes of the key players (farmers and service providers) were the main challenges encountered during technology generation and dissemination.
Recommendations for addressing the challenges listed above	There is a need to support production of basic seed and make it available for use amongst the end-users, It is also necessary to avail irrigation facilities and engage contract farmers to be producing basic seed. Production of basic seed should be promoted together with intensified promotional activities to motivate farmers to be using good quality seed. This entails the need for improving on communication channels through establishing innovation platforms for information sharing, packaging of appropriate extension messages to the users and use of appropriate channels. Creation of strong linkages and partnerships in the seed value chain is also necessary.
Lessons learnt on the best ways for addressing the challenges listed above	One of the lessons is on the need to ensure forward planning of the activities. This minimized the anticipated problems because mitigation measures are put in place. Creating awareness of the technology through oral means, brochures, demonstration plots and using innovation platforms can improve technology uptake. Use of lead farmers to encourage farmer to farmer extension and regular training of farmers are also important in technology dissemination.
Gender concern in the development and dissemination of the technology	Gender consideration in terms of labour required in the production of legumes and who benefits needs to be addressed. It is important that social barriers to both gender groups accessing these technologies be addressed.
Additional important information about the technology	The technologies are promoted to raise farmers' incomes through seed sales to the direct beneficiaries. However, the technologies have many other benefits to the consumers in improving their nutritional status.
Contact details of the generators and promotors of the technology	Seed Control and Certification Institute, P.O. Box 350199, Chilanga. Email address: nathpzm@yahoo.co.uk/ natanphiri@gmail.com, Telephone: +260 211 278236 Mobile: +260 973500965 /+260964867043 Country: Zambia Zambia Agriculture Research Institute, P/Bag 7, Chilanga, Email address: zaridirector@zari.gov.zm or mwalemp@yahoo.com, Telephone: +260 211 278130 Mobile: +260 966 766395, Country: Zambia

2.3 Cowpea technologies

2.3.1 Short maturing indeterminate Cowpea varieties

2.3.1.1 Cowpea variety – Msandile

Title of the technology or innovation	Short maturing indeterminate Cowpea variety – Msandile
Description of the technology	Msandile is a short maturing variety with indeterminate growth habit. It grows as a runner and has a potential yield of 0.9tons/ha. Msandile produces white violet flowers and light brown pods when they are mature. The testa and helium colours are yellow and black respectively.  Figure 15: Msandire copwpea variety
End users of the technology	The users of the variety are small-scale farmers, seed companies, processors and grain traders. This variety is used for direct human consumption, as animal feed and in confectionary industry
Critical and essential factors for successful promotion and adoption of the technology	Seeds availability, accessibility and affordability are amongst the critical factors towards successful promotion of the variety. Seed can be multiplied by small scale farmers. In addition, capacity of extension staff to sensitize farmers on the profitability of the crop and other nutritional benefits is essential. Furthermore, availability of credit support through farmers' groups/cooperatives, availability of extension services (public and private). The correct use of an appropriate delivery mechanism such as the dissemination through the private sector, ngos, government extension service. Decentralization of seed certification services (licensing of seed inspectors/samplers and laboratories)

Challenges encountered in respect to further dissemination of the technology, adoption and up/out scaling	inadequate basic seed, Droughts, quality of extension messages, Communication between various stakeholders, Recycling of seed competing with certified seed Mind set and altitudes of the key players (farmers and service providers)
Recommendations for addressing the challenges listed above	Produce more basic seed and make them available for use, avail irrigation facilities to facilitate production of basic seed and engagement in contract farming for basic seed, intensifying promotional activities for the technologies to motivate farmers use good quality seed, Improve on communication channels through establishing innovation platforms for information sharing Packaging of appropriate extension messages to the users and use of appropriate channels, Creation of strong linkages and partnerships in the seed value chain
Lessons learnt on the best ways for addressing the challenges listed above	Creating awareness of the technology through oral means, brochures, demonstration plots using lead farmers and innovation platforms can improve technology uptake. Regular training of farmers and farmer exchange visits are also important in technology dissemination
Gender concern in the development and dissemination of the technology	Gender consideration in terms of labour required in the production of legumes and who benefits needs to be addressed. Although training was implemented to the disseminators and deliberate measures were taken to ensure equity in assess of the technologies, it was important to address social barriers to both gender groups accessing these technologies.
Additional important information about the technology	The technologies are promoted to raise farmers' incomes through seed sales. However, the technologies have many other benefits to the consumers in improving their nutritional status.
Contact details of the generators and promotors of the technology	Seed Control and Certification Institute, P.O. Box 350199, Chilanga, nathpzm@yahoo.co.uk / natanphiri@gmail.com. Telephone: +260 211 278236, Mobile: +260 973500965 / +260964867043, Country: Zambia Zambia Agriculture Research Institute, P/Bag 7, Chilanga, Email address: zaridirector@zari.gov.zm or mwalemp@yahoo.com, Telephone: +260 211 278130, Mobile: +260 966 766395 Country: Zambia

2.3.2 Drought and low nitrogen tolerant cowpea varieties

2.3.2.1 Cowpea variety - IT00K-126-3

Title of the technology or innovation	Drought and low nitrogen tolerant cowpea variety - IT00K-126-3
Description of the technology	IT00K-126-3 is an indeterminant variety with cream seed, tolerant to drought and low nitrogen and has a yield potential of 3tons/ha. The variety is suitable for agro-ecological regions I, II and III of Zambia, and similar agro-ecologies. It is also tolerant to pests and diseases.
End users of the technology	The end-users of the variety are smallholder farmers, researchers, extension personnel and even traders.
Critical and essential factors for successful promotion and adoption of the technology	Critical factors for the promotion of the variety include (i) strong Research-Extension linkages, (ii) improved capacity among agro-dealers and seed companies, (iii) improved seed availability and access and finally (iv) intensified on-farm demonstrations. These are amongst the factors that are essential for promoting adoption of the variety.
Challenges encountered in respect to further dissemination of the technology, adoption and up/out scaling	Erratic rainfall patterns exacerbated by delayed fund release negatively affected the implementation of the project and consequently dissemination activities.
Recommendations for addressing the challenges listed above	There is a need to identify and support seed companies/ seed growers' associations that could be engaged in scaling up the multiplication and marketing of farmer preferred varieties.
Lessons learnt on the best ways for addressing the challenges listed above	Supporting and encouraging farmer exchange visits and strengthening the Lead Farmer-Follower farmer concept are key to addressing the challenges in technology generation and dissemination. Intensification of technology publicity through print and electronic media are also key to technology dissemination. Finally, timely disbursement of resources helps in proper planning and timely implementation of planned activities which can in turn mitigate against the erratic weather patterns.
Gender concern in the development and dissemination of the technology	There is still needed to emphasize on the nutrition aspect of the cowpea variety-utilization especially among children, pregnant and breast-feeding mothers. There is also a need to deliberately target women farmer clubs with the cowpea technologies, both in production (training, inputs) and utilization

Additional important information about the technology	There is need to integrate schools and health institutions in the production and utilization of cowpea. There is need to link farmers to the consumers and traders of cowpea
Contact details of the generators and promotors of the technology	Zambia Agriculture Research Institute, Email address: zaridirector@zari.gov.zm or mwalemp@yahoo.com, Telephone: +260 211 278130; Mobile: +260 966 766395, Country: Zambia Department of Agriculture, Email address: pklungu@yahoo.com, Telephone: +260 211 252029 Mobile: +260 966 80386 emchuma@yahoo.co.uk, Telephone: +260 211 223313 Mobile: +260 977764097, Country: Zambia

2.3.2.2 Cowpea variety - LTII-3-3-12

Title of the technology or innovation	Drought, low nitrogen and aphid tolerant determinate cowpea variety - LTII-3-3-12
Description of the technology	LTII-3-3-12 is a determinant variety with yield potential of 3tons/ha. It has cream to pink seed coat and is tolerant to drought and low nitrogen and aphids. The variety is suitable for agro-ecological regions I, II and III of Zambia.
End users of the technology	The end-users of the variety are smallholder farmers, researchers, extension personnel and even traders.
Critical and essential factors for successful promotion and adoption of the technology	Critical factors for the promotion of the variety include (i) strong Research-Extension linkages, (ii) improved capacity among agro-dealers and seed companies, (iii) improved seed availability and access and finally (iv) intensified on-farm demonstrations. These are amongst the factors that are essential for promoting adoption of the variety.
Challenges encountered in respect to further dissemination of the technology, adoption and up/out scaling	Erratic rainfall patterns exacerbated by delayed fund release negatively affected the implementation of the project and consequently dissemination activities.
Recommendations for addressing the challenges listed above	There is a need to identify and support seed companies/ seed growers' associations that could be engaged in scaling up the multiplication and marketing of farmer preferred varieties.

Lessons learnt on the best ways for addressing the challenges listed above	Supporting and encouraging farmer exchange visits and strengthening the Lead Farmer-Follower farmer concept are key to addressing the challenges in technology generation and dissemination. Intensification of technology publicity through print and electronic media are also key to technology dissemination. Finally, timely disbursement of resources helps in proper planning and timely implementation of planned activities which can in turn mitigate against the erratic weather patterns.
Gender concern in the development and dissemination of the technology	There is still needed to emphasize on the nutrition aspect of the cowpea variety-utilization especially among children, pregnant and breast-feeding mothers. There is also a need to deliberately target women farmer clubs with the cowpea technologies, both in production (training, inputs) and utilization
Additional important information about the technology	There is need to integrate schools and health institutions in the production and utilization of cowpea. There is need to link farmers to the consumers and traders of cowpea
Contact details of the generators and promotors of the technology	Zambia Agriculture Research Institute, Email address: zaridirector@zari.gov.zm or mwalemp@yahoo.com, Telephone: +260 211 278130, Mobile: +260 966 766395, Country: Zambia Department of Agriculture, Email address: pklungu@yahoo.com, Telephone: +260 211 252029 Mobile: +260 966 80386 emchuma@yahoo.co.uk, Telephone: +260 211 223313 Mobile: +260 977764097, Country: Zambia

2.3.2.3 Cowpea variety - IT-97K-556-4

Title of the technology or innovation	Drought and low nitrogen tolerant indeterminant cowpea variety - IT-97K-556-4
Description of the technology	IT-97K-556-4 is an indeterminant variety with potential yield of 3tons/ha. It has cream seed coat and is suited to agro-ecological regions I, II and III of Zambia.
End users of the technology	The end-users of the variety are smallholder farmers, researchers, extension personnel and even traders.

Critical and essential factors for successful promotion and adoption of the technology	Critical factors for the promotion of the variety include (i) strong Research-Extension linkages, (ii) improved capacity among agro-dealers and seed companies, (iii) improved seed availability and access and finally (iv) intensified on-farm demonstrations. These are amongst the factors that are essential for promoting adoption of the variety.
Challenges encountered in respect to further dissemination of the technology, adoption and up/out scaling	Erratic rainfall patterns exacerbated by delayed fund release negatively affected the implementation of the project and consequently dissemination activities.
Recommendations for addressing the challenges listed above	There is a need to identify and support seed companies/ seed growers' associations that could be engaged in scaling up the multiplication and marketing of farmer preferred varieties.
Lessons learnt on the best ways for addressing the challenges listed above	Supporting and encouraging farmer exchange visits and strengthening the Lead Farmer-Follower farmer concept are key to addressing the challenges in technology generation and dissemination. Intensification of technology publicity through print and electronic media are also key to technology dissemination. Finally, timely disbursement of resources helps in proper planning and timely implementation of planned activities which can in turn mitigate against the erratic weather patterns.
Gender concern in the development and dissemination of the technology	There is still needed to emphasize on the nutrition aspect of the cowpea variety-utilization especially among children, pregnant and breast-feeding mothers. There is also a need to deliberately target women farmer clubs with the cowpea technologies, both in production (training, inputs) and utilization
Additional important information about the technology	There is need to integrate schools and health institutions in the production and utilization of cowpea. There is need to link farmers to the consumers and traders of cowpea
Contact details of the generators and promotors of the technology	Zambia Agriculture Research Institute, Email address: zaridirector@zari.gov.zm or mwalemp@yahoo.com, Telephone: +260 211 278130 Mobile: +260 966 766395, Country: Zambia Department of Agriculture, Email address: pklungu@yahoo.com, Telephone: +260 211 252029 Mobile: +260 966 80386 emchuma@yahoo.co.uk, Telephone: +260 211 223313 Mobile: +260 977764097, Country: Zambia

2.3.2.4 Cowpea variety - LTII-3-3-14

Title of the technology or innovation	Drought, low nitrogen and aphid tolerant indeterminate cowpea variety - LTII-3-3-14
Description of the technology	LTII-3-3-14 is an indeterminate variety, with cream to pink seed coat, tolerant to drought, low nitrogen and aphids. It has a yield potential of 3tons/ha and is suitable for agro-ecological regions I, II and III of Zambia.
End users of the technology	The end-users of the variety are smallholder farmers, researchers, extension personnel and even traders.
Critical and essential factors for successful promotion and adoption of the technology	Critical factors for the promotion of the variety include (i) strong Research-Extension linkages, (ii) improved capacity among agro-dealers and seed companies, (iii) improved seed availability and access and finally (iv) intensified on-farm demonstrations. These are amongst the factors that are essential for promoting adoption of the variety.
Challenges encountered in respect to further dissemination of the technology, adoption and up/out scaling	Erratic rainfall patterns exacerbated by delayed fund release negatively affected the implementation of the project and consequently dissemination activities.
Recommendations for addressing the challenges listed above	There is a need to identify and support seed companies/ seed growers' associations that could be engaged in scaling up the multiplication and marketing of farmer preferred varieties.
Lessons learnt on the best ways for addressing the challenges listed above	Supporting and encouraging farmer exchange visits and strengthening the Lead Farmer-Follower farmer concept are key to addressing the challenges in technology generation and dissemination. Intensification of technology publicity through print and electronic media are also key to technology dissemination. Finally, timely disbursement of resources helps in proper planning and timely implementation of planned activities which can in turn mitigate against the erratic weather patterns.
Gender concern in the development and dissemination of the technology	There is still needed to emphasize on the nutrition aspect of the cowpea variety-utilization especially among children, pregnant and breast-feeding mothers. There is also a need to deliberately target women farmer clubs with the cowpea technologies, both in production (training, inputs) and utilization

Additional important information about the technology	There is need to integrate schools and health institutions in the production and utilization of cowpea. There is need to link farmers to the consumers and traders of cowpea
Contact details of the generators and promotors of the technology	Zambia Agriculture Research Institute, Email address: zaridirector@zari.gov.zm or mwalemp@yahoo.com, Telephone: +260 211 278130 Mobile: +260 966 766395, Country: Zambia Department of Agriculture, Email address: pklungu@yahoo.com, Telephone: +260 211 252029 Mobile: +260 966 80386 emchuma@yahoo.co.uk, Telephone: +260 211 223313 Mobile: +260 977764097, Country: Zambia

2.3.2.5 Cowpea variety - IT-97-1059-6

Title of the technology or innovation	Drought and low nitrogen tolerant determinate cowpea variety - IT-97-1059-6
Description of the technology	The variety has a determinant growth pattern, with a yield potential of 3tons/ha. The seed coat colour is cream. It is tolerant to drought and low nitrogen and is suitable for agro-ecological regions I, II and III of Zambia.
End users of the technology	The end-users of the variety are smallholder farmers, researchers, extension personnel and even traders.
Critical and essential factors for successful promotion and adoption of the technology	Critical factors for the promotion of the variety include (i) strong Research-Extension linkages, (ii) improved capacity among agro-dealers and seed companies, (iii) improved seed availability and access and finally (iv) intensified on-farm demonstrations. These are amongst the factors that are essential for promoting adoption of the variety.
Challenges encountered in respect to further dissemination of the technology, adoption and up/out scaling	Erratic rainfall patterns exacerbated by delayed fund release negatively affected the implementation of the project and consequently dissemination activities.
Recommendations for addressing the challenges listed above	There is a need to identify and support seed companies/ seed growers' associations that could be engaged in scaling up the multiplication and marketing of farmer preferred varieties.

Lessons learnt on the best ways for addressing the challenges listed above	Supporting and encouraging farmer exchange visits and strengthening the Lead Farmer-Follower farmer concept are key to addressing the challenges in technology generation and dissemination. Intensification of technology publicity through print and electronic media are also key to technology dissemination. Finally, timely disbursement of resources helps in proper planning and timely implementation of planned activities which can in turn mitigate against the erratic weather patterns.
Gender concern in the developmentanddissemination of the technology	There is still needed to emphasize on the nutrition aspect of the cowpea variety-utilization especially among children, pregnant and breast-feeding mothers. There is also a need to deliberately target women farmer clubs with the cowpea technologies, both in production (training, inputs) and utilization
Additional important information about the technology	There is need to integrate schools and health institutions in the production and utilization of cowpea. There is need to link farmers to the consumers and traders of cowpea
Contact details of the generators and promotors of the technology	Zambia Agriculture Research Institute, Email address: zaridirector@zari.gov.zm or mwalemp@yahoo.com, Telephone: +260 211 278130, Mobile: +260 966 766395, Country: Zambia Department of Agriculture, Email address: pklungu@yahoo.com, Telephone: +260 211 252029 Mobile: +260 966 80386 emchuma@yahoo.co.uk, Telephone: +260 211 223313 Mobile: +260 977764097, Country: Zambia

2.3.2.6 Cowpea variety - BB10-3-3-14

Title of the technology or innovation	Drought, low nitrogen and aphid tolerant indeterminate cowpea variety - BB10-3-3-14
Description of the technology	BB10-3-3-14 is an indeterminant variety with the yield potential of 3tons/ha. The seed coat colour is cream to pink. The variety is tolerant to drought, low nitrogen and aphids and is suitable for agro-ecological regions I, II and III of Zambia.

End users of the technology	Critical factors for the promotion of the variety include (i) strong Research-Extension linkages, (ii) improved capacity among agro-dealers and seed companies, (iii) improved seed availability and access and finally (iv) intensified on-farm demonstrations. These are amongst the factors that are essential for promoting adoption of the variety.
Critical and essential factors for successful promotion and adoption of the technology	Erratic rainfall patterns exacerbated by delayed fund release negatively affected the implementation of the project and consequently dissemination activities.
Challenges encountered in respect to further dissemination of the technology, adoption and up/out scaling	There is a need to identify and support seed companies/ seed growers' associations that could be engaged in scaling up the multiplication and marketing of farmer preferred varieties.
Recommendations for addressing the challenges listed above	Supporting and encouraging farmer exchange visits and strengthening the Lead Farmer-Follower farmer concept are key to addressing the challenges in technology generation and dissemination. Intensification of technology publicity through print and electronic media are also key to technology dissemination. Finally, timely disbursement of resources helps in proper planning and timely implementation of planned activities which can in turn mitigate against the erratic weather patterns.
Lessons learnt on the best ways for addressing the challenges listed above	There is still needed to emphasize on the nutrition aspect of the cowpea variety-utilization especially among children, pregnant and breast-feeding mothers. There is also a need to deliberately target women farmer clubs with the cowpea technologies, both in production (training, inputs) and utilization
Gender concern in the development and dissemination of the technology	There is need to integrate schools and health institutions in the production and utilization of cowpea. There is need to link farmers to the consumers and traders of cowpea
Additional important information about the technology	Critical factors for the promotion of the variety include (i) strong Research-Extension linkages, (ii) improved capacity among agro-dealers and seed companies, (iii) improved seed availability and access and finally (iv) intensified on-farm demonstrations. These are amongst the factors that are essential for promoting adoption of the variety.

Contact details of the generators and promotors of the technology	Zambia Agriculture Research Institute, Email address: zaridirector@zari.gov.zm or mwalemp@yahoo.com, Telephone: +260 211 278130, Mobile: +260 966 766395, Country: Zambia Department of Agriculture, Email address: pklungu@yahoo.com, Telephone: +260 211 252029 Mobile: +260 966 80386 emchuma@yahoo.co.uk, Telephone: +260 211 223313 Mobile: +260 977764097, Country: Zambia

2.3.2.7 Cowpea variety -IT-90K-277

Title of the technology or innovation	Drought and low nitrogen tolerant indeterminate cowpea variety -IT-90K-277
Description of the technology	IT-90K-277 is an indeterminant variety tolerant to drought and low nitrogen. It has a yield potential of 3tons/ha and the seed coat is cream/mottling. The variety is suitable for agro-ecological regions I, II and III of Zambia.
End users of the technology	Critical factors for the promotion of the variety include (i) strong Research-Extension linkages, (ii) improved capacity among agro-dealers and seed companies, (iii) improved seed availability and access and finally (iv) intensified on-farm demonstrations. These are amongst the factors that are essential for promoting adoption of the variety.
Critical and essential factors for successful promotion and adoption of the technology	Erratic rainfall patterns exacerbated by delayed fund release negatively affected the implementation of the project and consequently dissemination activities.
Challenges encountered in respect to further dissemination of the technology, adoption and up/out scaling	There is a need to identify and support seed companies/ seed growers' associations that could be engaged in scaling up the multiplication and marketing of farmer preferred varieties.
Recommendations for addressing the challenges listed above	Supporting and encouraging farmer exchange visits and strengthening the Lead Farmer-Follower farmer concept are key to addressing the challenges in technology generation and dissemination. Intensification of technology publicity through print and electronic media are also key to technology dissemination. Finally, timely disbursement of resources helps in proper planning and timely implementation of planned activities which can in turn mitigate against the erratic weather patterns.

Lessons learnt on the best ways for addressing the challenges listed above	There is still needed to emphasize on the nutrition aspect of the cowpea variety-utilization especially among children, pregnant and breast-feeding mothers. There is also a need to deliberately target women farmer clubs with the cowpea technologies, both in production (training, inputs) and utilization
Gender concern in the development and dissemination of the technology	There is need to integrate schools and health institutions in the production and utilization of cowpea. There is need to link farmers to the consumers and traders of cowpea
Additional important information about the technology	Critical factors for the promotion of the variety include (i) strong Research-Extension linkages, (ii) improved capacity among agro-dealers and seed companies, (iii) improved seed availability and access and finally (iv) intensified on-farm demonstrations. These are amongst the factors that are essential for promoting adoption of the variety.
Contact details of the generators and promotors of the technology	Zambia Agriculture Research Institute, Email address: zaridirector@zari.gov.zm or mwalemp@yahoo.com, Telephone: +260 211 278130, Mobile: +260 966 766395, Country: Zambia Department of Agriculture, Email address: pklungu@yahoo.com, Telephone: +260 211 252029 Mobile: +260 966 80386 emchuma@yahoo.co.uk, Telephone: +260 211 223313 Mobile: +260 977764097, Country: Zambia

2.3.2.8 Cowpea variety - IT-89K-288

Title of the technology or innovation	Drought and low nitrogen tolerant indeterminate cowpea variety - IT-89K-288
Description of the technology	IT-89K-288 is an indeterminant variety, with cream/pink seed coat and tolerates drought and low nitrogen. It has a yield potential of 3tons/ha and is recommended for agro-ecological regions I, II and III of Zambia.
End users of the technology	Critical factors for the promotion of the variety include (i) strong Research-Extension linkages, (ii) improved capacity among agro-dealers and seed companies, (iii) improved seed availability and access and finally (iv) intensified on-farm demonstrations. These are amongst the factors that are essential for promoting adoption of the variety.

Critical and essential factors for successful promotion and adoption of the technology	Erratic rainfall patterns exacerbated by delayed fund release negatively affected the implementation of the project and consequently dissemination activities.
Challenges encountered in respect to further dissemination of the technology, adoption and up/out scaling	There is a need to identify and support seed companies/ seed growers' associations that could be engaged in scaling up the multiplication and marketing of farmer preferred varieties.
Recommendations for addressing the challenges listed above	Supporting and encouraging farmer exchange visits and strengthening the Lead Farmer-Follower farmer concept are key to addressing the challenges in technology generation and dissemination. Intensification of technology publicity through print and electronic media are also key to technology dissemination. Finally, timely disbursement of resources helps in proper planning and timely implementation of planned activities which can in turn mitigate against the erratic weather patterns.
Lessons learnt on the best ways for addressing the challenges listed above	There is still needed to emphasize on the nutrition aspect of the cowpea variety-utilization especially among children, pregnant and breast-feeding mothers. There is also a need to deliberately target women farmer clubs with the cowpea technologies, both in production (training, inputs) and utilization
Gender concern in the development and dissemination of the technology	There is need to integrate schools and health institutions in the production and utilization of cowpea. There is need to link farmers to the consumers and traders of cowpea
Additional important information about the technology	Critical factors for the promotion of the variety include (i) strong Research-Extension linkages, (ii) improved capacity among agro-dealers and seed companies, (iii) improved seed availability and access and finally (iv) intensified on-farm demonstrations. These are amongst the factors that are essential for promoting adoption of the variety.
Contact details of the generators and promotors of the technology	Zambia Agriculture Research Institute, Email address: zaridirector@zari.gov.zm or mwalemp@yahoo.com, Telephone: +260 211 278130, Mobile: +260 966 766395, Country: Zambia Department of Agriculture, Email address: pklungu@yahoo.com, Telephone: +260 211 252029 Mobile: +260 966 80386 emchuma@yahoo.co.uk, Telephone: +260 211 223313 Mobile: +260 977764097, Country: Zambia

2.3.2.9 Cowpea variety – Lutembwe

Title of the technology or innovation	Drought and low nitrogen tolerant determinate cowpea variety - Lutembwe
Description of the technology	Lutembwe is a determinate variety with cream/pink seed coat and has a yield potential of 3tons/ha. It tolerates drought and low nitrogen and is suitable for agro-ecological regions I, II and III of Zambia.
End users of the technology	Critical factors for the promotion of the variety include (i) strong Research-Extension linkages, (ii) improved capacity among agro-dealers and seed companies, (iii) improved seed availability and access and finally (iv) intensified on-farm demonstrations. These are amongst the factors that are essential for promoting adoption of the variety.
Critical and essential factors for successful promotion and adoption of the technology	Erratic rainfall patterns exacerbated by delayed fund release negatively affected the implementation of the project and consequently dissemination activities.
Challenges encountered in respect to further dissemination of the technology, adoption and up/out scaling	There is a need to identify and support seed companies/ seed growers' associations that could be engaged in scaling up the multiplication and marketing of farmer preferred varieties.
Recommendations for addressing the challenges listed above	Supporting and encouraging farmer exchange visits and strengthening the Lead Farmer-Follower farmer concept are key to addressing the challenges in technology generation and dissemination. Intensification of technology publicity through print and electronic media are also key to technology dissemination. Finally, timely disbursement of resources helps in proper planning and timely implementation of planned activities which can in turn mitigate against the erratic weather patterns.
Lessons learnt on the best ways for addressing the challenges listed above	There is still needed to emphasize on the nutrition aspect of the cowpea variety-utilization especially among children, pregnant and breast-feeding mothers. There is also a need to deliberately target women farmer clubs with the cowpea technologies, both in production (training, inputs) and utilization
Gender concern in the development and dissemination of the technology	There is need to integrate schools and health institutions in the production and utilization of cowpea. There is need to link farmers to the consumers and traders of cowpea

Additional important information about the technology	Critical factors for the promotion of the variety include (i) strong Research-Extension linkages, (ii) improved capacity among agro-dealers and seed companies, (iii) improved seed availability and access and finally (iv) intensified on-farm demonstrations. These are amongst the factors that are essential for promoting adoption of the variety.
Contact details of the generators and promotors of the technology	Zambia Agriculture Research Institute, Email address: zaridirector@zari.gov.zm or mwalemp@yahoo.com, Telephone: +260 211 278130 Mobile: +260 966 766395, Country: Zambia Department of Agriculture, Email address: pklungu@yahoo.com, Telephone: +260 211 252029 Mobile: +260 966 80386 emchuma@yahoo.co.uk, Telephone: +260 211 223313 Mobile: +260 977764097, Country: Zambia

2.4 Groundnuts technologies

2.4.1 High yielding and high oil content groundnut varieties

2.4.1.1 Groundnut variety- MGV4 (CG-7)

Title of the technology or innovation	High yielding and high oil content groundnut variety- MGV4 (CG-7)
Description of the technology	MGV4 is a Virginia bunch variety. It was first released in Zambia as Msekera Groundnut Variety 4 (MGV-4) and is known as CG-7 in Malawi while in Uganda, it is called Serenut IR. MGV-4 is currently the only variety that shows high kernel yield potential in all three agro-ecological regions. It matures in 120 day-140 days and is easy to harvest because of its bunch growth habits. The kernels are red, uniform, medium in size, contains 48-50% oil and has an Oleo/Linolinic (O/L) ratio of 1.5 indicating a good shelf life.
 Figure 16: MGV4 groundnut variety	 igure 17: Field demonstration of MGV4 groundnut variety
End users of the technology	The users of the technologies are small-scale farmers, seed companies, processors and grain traders. This variety is used for direct human consumption, in animal feed and confectionery industry.

Critical and essential factors for successful promotion and adoption of the technology	Seeds availability, accessibility and affordability by small scale farmers are critical factors for the successful promotion and adoption of the variety. Small scale seed multipliers are key in availing the variety. Another factor is the capacity of extension staff to sensitize farmers on the profitability of the crop and other nutritional benefits. In addition, availability of credit support through farmers' groups/cooperatives, availability of public and private extension services coupled with the correct use of appropriate delivery mechanism such as the dissemination through the private sector, NGOs, government extension service are critical. Finally, decentralization of seed certification services (licensing of seed inspectors/samplers and laboratories) constitute key areas in supporting dissemination and adoption.
Challenges encountered in respect to further dissemination of the technology, adoption and up/out scaling	Inadequate basic seed, droughts, quality of extension messages, poor communication amongst various stakeholders, recycling of seed, mind set and altitudes of the key players (farmers and service providers) were the main challenges encountered during dissemination.
Recommendations for addressing the challenges listed above	It is recommended that more basic seed should be produced to make them available for use. Secondly, availing irrigation facilities and engagement in contract farming for basic seed will facilitate production of basic seed. Thirdly, there is a need for intensifying promotional activities for the technologies to motivate farmers use good quality seed. Other recommendations include (i) the need to improve on communication channels through establishing innovation platforms for information sharing, (ii) packaging of appropriate extension messages to the users and (iii) use of appropriate channels, (iv) Creation of strong linkages and partnerships in the seed value chain
Lessons learnt on the best ways for addressing the challenges listed above	Some of the lessons learnt were on the need for forward planning to ensure timely implementation of activities while creating awareness of the technology through oral means, brochures, demonstration plots and through use of innovation platforms led to an improvement in technology uptake. Use of lead farmers to encourage farmer to farmer extension and regular trainings of farmers and farmer exchange visits are important in technology dissemination.

Gender concern in the developmentanddissemination of the technology	Gender consideration in terms of labour required in the production of legumes and who benefits needs to be addressed. Although training was implemented to the disseminators and deliberate measures were taken to ensure equity in assess of the technologies, it was important that social barriers to both gender groups accessing these technologies were addressed
Additional important information about the technology	The technologies were promoted to raise farmers' incomes through seed sales to the direct beneficiaries. However, the technologies have many other benefits to the consumers in improving their nutritional status
Contact details of the generators and promotors of the technology	Seed Control and Certification Institute, P.O. Box 350199, Chilanga Email address: nathpzm@yahoo.co.uk/natanphiri@gmail.com Telephone: +260 211 278236 Mobile: +260 973500965/+260964867043, Country: Zambia Zambia Agriculture Research Institute, P/Bag 7, Chilanga Email address:zaridirector@zari.gov.zm or mwalemp@yahoo.com, Telephone: +260 211 278130, Mobile: +260 966 766395, Country: Zambia

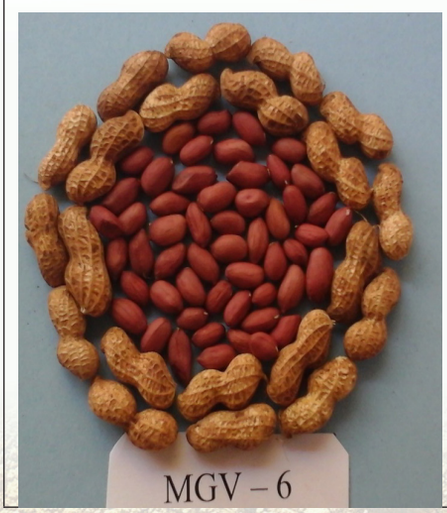
2.4.1.2 Groundnut variety- MGV5

Title of the technology or innovation	High yielding and confectionery groundnut variety- MGV5
Description of the technology  Figure 18: MGV5 ground nut variety	MGV-5 was a recently released Virginia runner type variety with large attractive tan-coloured kernels that are an excellent, high-yielding substitute for Chalimbana, Africa's best-known variety. It is particularly suitable for confectionery with a 48% oil content, an O/L ratio of 1.5 and roasts evenly softer texture. It is well adapted for production in the plateau regions of Zambia, maturing in 120 days, and has a kernel yield of about 2.0 t/ha with smallholder farmers.

End users of the technology	The users of the technologies are small-scale farmers, seed companies, processors and grain traders, These varieties are used for direct human consumption, for animal feed and confectionary industries.
Critical and essential factors for successful promotion and adoption of the technology	Seeds availability, accessibility and affordability by small scale farmers are critical factors for the successful promotion and adoption of the variety. Small scale seed multipliers are key in availing the variety. Another factor is the capacity of extension staff to sensitize farmers on the profitability of the crop and other nutritional benefits. In addition, availability of credit support through farmers' groups/cooperatives, availability of public and private extension services coupled with the correct use of appropriate delivery mechanism such as the dissemination through the private sector, NGOs, government extension service are critical. Finally, decentralization of seed certification services (licensing of seed inspectors/samplers and laboratories) constitute key areas in supporting dissemination and adoption.
Challenges encountered in respect to further dissemination of the technology, adoption and up/out scaling	Inadequate basic seed, droughts, quality of extension messages, poor communication amongst various stakeholders, recycling of seed, mind set and altitudes of the key players (farmers and service providers) were the main challenges encountered during dissemination.
Recommendations for addressing the challenges listed above	It is recommended that more basic seed should be produced to make them available for use. Secondly, availing irrigation facilities and engagement in contract farming for basic seed will facilitate production of basic seed. Thirdly, there is a need for intensifying promotional activities for the technologies to motivate farmers use good quality seed. Other recommendations include (i) the need to improve on communication channels through establishing innovation platforms for information sharing, (ii) packaging of appropriate extension messages to the users and (iii) use of appropriate channels, (iv) Creation of strong linkages and partnerships in the seed value chain
Lessons learnt on the best ways for addressing the challenges listed above	Some of the lessons learnt were on the need for forward planning to ensure timely implementation of activities while creating awareness of the technology through oral means, brochures, demonstration plots and through use of innovation platforms led to an improvement in technology uptake. Use of lead farmers to encourage farmer to farmer extension and regular trainings of farmers and farmer exchange visits are important in technology dissemination.

Gender concern in the developmentanddissemination of the technology	Gender consideration in terms of labour required in the production of legumes and who benefits needs to be addressed. Although training was implemented to the disseminators and deliberate measures were taken to ensure equity in assess of the technologies, it was important that social barriers to both gender groups accessing these technologies were addressed
Additional important information about the technology	The technologies were promoted to raise farmers' incomes through seed sales to the direct beneficiaries. However, the technologies have many other benefits to the consumers in improving their nutritional status
Contact details of the generators and promotors of the technology	Seed Control and Certification Institute, P.O. Box 350199, Chilanga Email address: nathpzm@yahoo.co.uk/natanphiri@gmail.com Telephone: +260 211 278236 Mobile: +260 973500965/+260964867043, Country: Zambia Zambia Agriculture Research Institute, P/Bag 7, Chilanga Email address: zaridirector@zari.gov.zm or mwalemp@yahoo.com, Telephone: +260 211 278130, Mobile: +260 966 766395, Country: Zambia

2.4.1.3 Groundnut variety: MGV-6

Title of the technology or innovation	High yielding and rust tolerant groundnut variety: MGV-6
Description of the technology  	MGV-6 was developed in 2016 as an improvement over MGV-4 groundnut seed variety version which was developed 25 years earlier. MGH-6 out yields MGV-4 by 20-30 %, tolerant to rust diseases and moderately tolerant to chronic leaf spot diseases. It matures earlier than MGV-4 and tolerate drought more than MGV-4. The variety has more constricted pods with less pronounced beaks Figure 19: MGV6 groundnut variety

End users of the technology	Resource constrained small-scale producers, the majority of whom are women.
Critical and essential factors for successful promotion and adoption of the technology	Seed availability, access and provision remain the challenging constant/bottleneck to dissemination. Crop-livestock integration can be enhanced as the high protein groundnut haulms can sustain not only livestock production but also boost high value milk production under the small-scale farming enterprise.
Challenges encountered in respect to further dissemination of the technology, adoption and up/out scaling	Unavailability of seeds
Recommendations for addressing the challenges listed above	There is a need to promote small scale seed production.
Lessons learnt on the best ways for addressing the challenges listed above	Adoption of the technology that does not require the use of insecticides and fungicides enhance food and environmental safety.
Gender concern in the development and dissemination of the technology	There was no gender concern
Additional important information about the technology	None
Contact details of the generators and promotors of the technology	Director Zambia Agriculture Research Institute P/B 1 Chilanga, Zambia

2.4.1.4 Groundnut variety: MGV-7

Title of the technology or innovation	High yielding, confectionery and tolerant to rosette: MGV-7
Description of the technology	MGV-7 was developed in 2016 as an improvement over MGV-4 groundnut which had been on the market for 25years. MHV-7 out yields MGV-4 by 20-30 %, is tolerant to sporadic rosette virus diseases, moderately tolerate to chronic leaf spot diseases and matures a week earlier than MGV-4. It has more oil content (52%) than MGV-4. It also tolerates drought more than MGV-4, has larger and bolder seeds with light colour. The pods are less constricted and have more pronounced beak.

Figure 20: MGV7 groundnut variety

End users of the technology	Resource constrained small-scale producers, the majority of whom are women
Critical and essential factors for successful promotion and adoption of the technology	Seed availability, access and provision remains a challenging constant/bottleneck to dissemination. Crop-livestock integration can be enhanced as the high protein groundnut haulms can sustain not only livestock production but also boost high value milk production under the small-scale farming enterprises.
Challenges encountered in respect to further dissemination of the technology, adoption and up/out scaling	Unavailability of seeds
Recommendations for addressing the challenges listed above	The involvement of private seed companies will enhance seed availability.
Lessons learnt on the best ways for addressing the challenges listed above	In addition, food and environmental safety is enhanced as adoption of the technology does not entail use of insecticides and fungicides.
Gender concern in the development and dissemination of the technology	None
Additional important information about the technology	None
Contact details of the generators and promotors of the technology	Director Zambia Agriculture Research Institute P/B 1 Chilanga, Zambia

2.4.1.5 Groundnut variety- Chishango

Title of the technology or innovation	Commercial groundnut variety- Chishango
Description of the technology	This is a Virginia bunch variety that grows well in the eastern parts of Zambia and matures in 120 days. It has kernels that are tan pink, uniform, medium in size, contains 47% oil and has an O/L ratio of 1.5. It has a kernel yield of 2.0 t/ha and is suitable for the confectionery market.
End users of the technology	The users of the technologies are small-scale farmers as per recommended regions. Other users include seed companies, processors, grain traders. These varieties are used for direct human consumption, the animal feed industry and confectionary industry
Critical and essential factors for successful promotion and adoption of the technology	Seeds availability, accessibility and affordability by small scale farmers are critical factors for the successful promotion and adoption of the variety. Small scale seed multipliers are key in availing the variety. Another factor is the capacity of extension staff to sensitize farmers on the profitability of the crop and other nutritional benefits. In addition, availability of credit support through farmers' groups/cooperatives, availability of public and private extension services coupled with the correct use of appropriate delivery mechanism such as the dissemination through the private sector, NGOs, government extension service are critical. Finally, decentralization of seed certification services (licensing of seed inspectors/samplers and laboratories) constitute key areas in supporting dissemination and adoption.

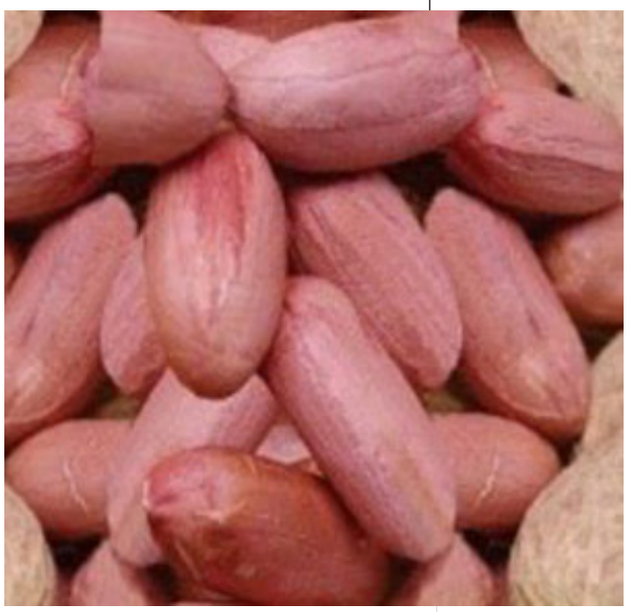


Figure 21: Chishango groundnut variety

Challenges encountered in respect to further dissemination of the technology, adoption and up/out scaling	Inadequate basic seed, droughts, quality of extension messages, poor communication amongst various stakeholders, recycling of seed, mind set and altitudes of the key players (farmers and service providers) were the main challenges encountered during dissemination.
Recommendations for addressing the challenges listed above	It is recommended that more basic seed should be produced to make them available for use. Secondly, availing irrigation facilities and engagement in contract farming for basic seed will facilitate production of basic seed. Thirdly, there is a need for intensifying promotional activities for the technologies to motivate farmers use good quality seed. Other recommendations include (i) the need to improve on communication channels through establishing innovation platforms for information sharing, (ii) packaging of appropriate extension messages to the users and (iii) use of appropriate channels, (iv) Creation of strong linkages and partnerships in the seed value chain
Lessons learnt on the best ways for addressing the challenges listed above	Some of the lessons learnt were on the need for forward planning to ensure timely implementation of activities while creating awareness of the technology through oral means, brochures, demonstration plots and through use of innovation platforms led to an improvement in technology uptake. Use of lead farmers to encourage farmer to farmer extension and regular trainings of farmers and farmer exchange visits are important in technology dissemination.
Gender concern in the developmentanddissemination of the technology	Gender consideration in terms of labour required in the production of legumes and who benefits needs to be addressed. Although training was implemented to the disseminators and deliberate measures were taken to ensure equity in assess of the technologies, it was important that social barriers to both gender groups accessing these technologies were addressed
Additional important information about the technology	The technologies were promoted to raise farmers' incomes through seed sales to the direct beneficiaries. However, the technologies have many other benefits to the consumers in improving their nutritional status

Contact details of the generators and promotors of the technology	Seed Control and Certification Institute, P.O. Box 350199, Chilanga Email address: nathpzm@yahoo.co.uk/ natanphiri@gmail.com Telephone: +260 211 278236 Mobile: +260 973500965/+260964867043, Country: Zambia Zambia Agriculture Research Institute, P/Bag 7, Chilanga Email address: zaridirector@zari.gov.zm or mwalemp@yahoo.com, Telephone: +260 211 278130, Mobile: +260 966 766395, Country: Zambia

2.4.1.6 Groundnut variety- Katete

Title of the technology or innovation	High yielding and oil content groundnut variety- Katete
Description of the technology	Katete was released in 2008, it takes 90 to 100 days to mature and has 43% oil content. It has tan kennel colour and yields between 1 and 1.5tonsha^{-1}
End users of the technology	The users of the technologies are small-scale farmers as per recommended regions. Other users include seed companies, processors, grain traders. These varieties are used for direct human consumption, the animal feed industry and confectionary industry
Critical and essential factors for successful promotion and adoption of the technology	Seeds availability, accessibility and affordability by small scale farmers are critical factors for the successful promotion and adoption of the variety. Small scale seed multipliers are key in availing the variety. Another factor is the capacity of extension staff to sensitize farmers on the profitability of the crop and other nutritional benefits. In addition, availability of credit support through farmers' groups/cooperatives, availability of public and private extension services coupled with the correct use of appropriate delivery mechanism such as the dissemination through the private sector, NGOs, government extension service are critical. Finally, decentralization of seed certification services (licensing of seed inspectors/samplers and laboratories) constitute key areas in supporting dissemination and adoption.

Challenges encountered in respect to further dissemination of the technology, adoption and up/out scaling	Inadequate basic seed, droughts, quality of extension messages, poor communication amongst various stakeholders, recycling of seed, mind set and altitudes of the key players (farmers and service providers) were the main challenges encountered during dissemination.
Recommendations for addressing the challenges listed above	It is recommended that more basic seed should be produced to make them available for use. Secondly, availing irrigation facilities and engagement in contract farming for basic seed will facilitate production of basic seed. Thirdly, there is a need for intensifying promotional activities for the technologies to motivate farmers use good quality seed. Other recommendations include (i) the need to improve on communication channels through establishing innovation platforms for information sharing, (ii) packaging of appropriate extension messages to the users and (iii) use of appropriate channels, (iv) Creation of strong linkages and partnerships in the seed value chain
Lessons learnt on the best ways for addressing the challenges listed above	Some of the lessons learnt were on the need for forward planning to ensure timely implementation of activities while creating awareness of the technology through oral means, brochures, demonstration plots and through use of innovation platforms led to an improvement in technology uptake. Use of lead farmers to encourage farmer to farmer extension and regular trainings of farmers and farmer exchange visits are important in technology dissemination.
Gender concern in the developmentanddissemination of the technology	Gender consideration in terms of labour required in the production of legumes and who benefits needs to be addressed. Although training was implemented to the disseminators and deliberate measures were taken to ensure equity in assess of the technologies, it was important that social barriers to both gender groups accessing these technologies were addressed
Additional important information about the technology	The technologies were promoted to raise farmers' incomes through seed sales to the direct beneficiaries. However, the technologies have many other benefits to the consumers in improving their nutritional status

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2.4.2. High yielding groundnut variety

2.4.2.1 Groundnuts variety - ICGV-SM 99568

Title of the technology or innovation	High yielding groundnut variety (ICGV-SM 99568)
Description of the technology	ICGV-SM 99568 is a Spanish type, released in 2011. It has a yield potential of 2.8 t / ha with medium size grain and resistant to rosette. The variety is recommended in all agro-ecological zones of Zambia.
End users of the technology	The end-users are smallholder farmers, millers, traders, research and extension personnel
Critical and essential factors for successful promotion and adoption of the technology	Strong research-extension linkages, improved capacity among agro-dealers and seed companies, improved seed availability and access and intensified on-farm demonstrations are the critical factors for the successful technology promotion and consequent adoption.
Challenges encountered in respect to further dissemination of the technology, adoption and up/out scaling	The first challenge was inadequate seed to avail to farmers who e expressed interest to produce. Secondly, inputs were procured late in the season and this affected the implementation of the dissemination activities.
Recommendations for addressing the challenges listed above	There is need for seed multiplication subproject to move in and establish seed multiplication facilities for all the legume categories and liaise with agro-dealers for possible stocking of the promoted varieties.

Lessons learnt on the best ways for addressing the challenges listed above	Consistent farmer-extension interaction at all the dissemination forums is essential. Seed multiplication should not be limited to the project but extended to the private sector that are interested to multiply seed.
Gender concern in the developmentanddissemination of the technology	In the mainstreaming of the project activities, gender is emphasized and even among the beneficiaries, there is emphasis on at least 30% female participation. There is need for the subproject dealing with legume utilization to target the same farmers, women included who are direct project beneficiaries of the legume dissemination technology.
Additional important information about the technology	Linking farmers to seed multiplication team and exiting markets by agro-processors dealing edible oil production are ready to take all the soybeans volume as demand is more than the current country production.
Contact details of the generators and promotors of the technology	Mozambican Agricultural Research Institute - Email address: Telephone: Mobile: Country: Mozambique

2.5 Pigeon pea technologies

2.5.1 Improved long duration pigeon pea varieties

2.5.1.1 Pigeon pea - ICEAP 00040

Title of the technology or innovation	Improved long duration pigeon pea- ICEAP 00040
Description of the technology	ICEAP 00040 is a large seed and long duration variety recommended for high rainfall areas. It takes 240days to mature and has a potential yield of 2tons/ha. The variety is tolerant to fusarium wilt. The stem has green colour while the seed is cream.
End users of the technology	Smallholder farmers (farmer associations/farmer group or individual farmers), partners (NGO, Private sector, Extension Division, agrodealers and seed companies
Critical and essential factors for successful promotion and adoption of the technology	Involvement of Extension services, NGO'S, seed companies
Challenges encountered in respect to further dissemination of the technology, adoption and up/out scaling	Limited resources for extension workers mainly for SDAEs
Recommendations for addressing the challenges listed above	Availability of funds at right time to make sure that we will manage all activity proposed. Make sure that enough pigeon pea seed is produced not only basic seed, but certified seeds by seed companies
Lessons learnt on the best ways for addressing the challenges listed above	The participatory varieties selection has been one of the strategies that is gives rapid varieties adoption. Learning by seeing (demo-plots) was very crucial to the farmers The demo-plot size is very crucial to compare the technologies that are been tested under farmers
Gender concern in the development and dissemination of the technology	Women are very well involved in crop production to guarantee food security issues, that are usually been done in small area around to their home. This last year, the price was high and, this encourage the farms, principally men to produce in large área

Additional important information about the technology	Pigeon pea strengthen the capacity of farmers and enhance the livelihood of small holder farmers through enhanced food security and increased income The varieties are being used are realized varieties with very high potential
Contact details of the generators and promotors of the technology	IIAM-CZnd (Nampula) Email address: mcdonca2001@gmail.com Mobile: +258-84-52-95-565, +258-82-60-03-503 Country: Mozambique

2.5.1.2 Pigeon pea - ICEAP 9145

Title of the technology or innovation	Improved long duration pigeon pea- ICEAP 9145
Description of the technology	ICPL 9145 has a purple/red stem, yields 2 ton/ha and is resistant to fusarium wilt. It has white cream large seeds. It is a long duration variety, recommended for high rainfall areas. It takes 240 days to mature. Mature pods are purple or green with purple stripes)
End users of the technology	Smallholder farmers (farmer associations/farmer group or individual farmers), partners (NGO, Private sector, Extension Division, agrodealers and seed companies.
Critical and essential factors for successful promotion and adoption of the technology	Involvement of Extension services, NGO'S, seed companies
Challenges encountered in respect to further dissemination of the technology, adoption and up/out scaling	Limited resources for extension workers mainly for SDAEs
Recommendations for addressing the challenges listed above	Availability of funds at right time to make sure that we will manage all activity proposed. Make sure that enough pigeon pea seed is produced not only basic seed, but certified seeds by seed companies
Lessons learnt on the best ways for addressing the challenges listed above	The participatory varieties selection has been one of the strategies that is gives rapid varieties adoption. Learning by seeing (demo-plots) was very crucial to the farmers The demo-plot size is very crucial to compare the technologies that are been tested under farmers

Gender concern in the developmentanddissemination of the technology	Women are very well involved in crop production to guarantee food security issues, that are usually been done in small area around to their home. This last year, the price was high and, this encourage the farms, principally men to produce in large área
Additional important information about the technology	Pigeon pea strengthen the capacity of farmers and enhance the livelihood of small holder farmers through enhanced food security and increased income The varieties are being used are realized varieties with very high potential
Contact details of the generators and promotors of the technology	IIAM-CZnd (Nampula) Email address: mcdonca2001@gmail.com Mobile: +258-84-52-95-565, +258-82-60-03-503 Country: Mozambique

2.5.2 Improved medium duration pigeon pea varieties

2.5.2.1 Pigeon pea variety- ICEAP 00554

Title of the technology or innovation	Improved medium duration pigeon pea- ICEAP 00554
Description of the technology	ICEAP 00554 matures within 180 days and yields up to 2.5 tonha^{-1}. It is resistant to fusarium wilt and green stems. It is more indeterminate compared to ICEAP 00557.
End users of the technology	Smallholder farmers (farmer associations/farmer group or individual farmers), partners (NGO, Private sector, Extension Division, agrodealers and seed companies.
Critical and essential factors for successful promotion and adoption of the technology	Involvement of Extension services, NGO'S, seed companies
Challenges encountered in respect to further dissemination of the technology, adoption and up/out scaling	Limited resources for extension workers mainly for SDAEs

Recommendations for addressing the challenges listed above	Availability of funds at right time to make sure that we will manage all activity proposed. Make sure that enough pigeon pea seed is produced not only basic seed, but certified seeds by seed companies
Lessons learnt on the best ways for addressing the challenges listed above	The participatory varieties selection has been one of the strategies that is gives rapid varieties adoption. Learning by seeing (demo-plots) was very crucial to the farmers. The demo-plot size is very crucial to compare the technologies that are been tested under farmers.
Gender concern in the development and dissemination of the technology	Women are very well involved in crop production to guarantee food security issues, that are usually been done in small area around to their home. This last year, the price was high and, this encourage the farms, principally men to produce in large area
Additional important information about the technology	Pigeon pea strengthen the capacity of farmers and enhance the livelihood of small holder farmers through enhanced food security and increased income The varieties are being used are realized varieties with very high potential
Contact details of the generators and promotors of the technology	IIAM-CZnd (Nampula) Email address: mcdonca2001@gmail.com Mobile: +258-84-52-95-565, +258-82-60-03-503 Country: Mozambique

2.5.2.2 Pigeon pea variety - 00557

Title of the technology or innovation	Improved Pigeon Pea variety (00557)
Description of the technology	ICEAP 00557 is a distinct, stable and uniform variety. The stem colour is green. At optimum temperature for growth, it flowers and matures in about 130 days and 180 days, respectively. It is non-determinate and semi-spreading in growth habit. The open flower is yellow in colour with dense streaks. The immature pods are green with light to dense stripes, long and sickle shaped. Each pod contains 6-7 seeds. Seeds are large white/cream with 100-seed mass of 17-19 g. It has the potential yield up to 2.5 t ha^{-1}. It is tolerant to Fusarium wilt and most common leaf diseases.

End users of the technology	Smallholder farmers, Millers/Traders, Research-Extension
Critical and essential factors for successful promotion and adoption of the technology	Strong Research-Extension Linkages, Improved capacity among agro-dealers and seed stockists, Improved seed availability and access, Intensified on-farm demonstrations
Challenges encountered in respect to further dissemination of the technology, adoption and up/out scaling	The promoted varieties not available for farmers though a lot of them have expressed interest. Delays in procurement of inputs
Recommendations for addressing the challenges listed above	There is need for seed multiplication subproject to move in and establish seed multiplication facilities for all the legume categories and lease with agro-dealers for possible stocking of the promoted varieties
Lessons learnt on the best ways for addressing the challenges listed above	Consistent farmer-extension interaction at all the dissemination forums is essential. Seed multiplication should not be limited to the project but extended to the private sector that are interested to multiply seed.
Gender concern in the development and dissemination of the technology	In the mainstreaming of the project activities, gender is emphasized and even among the beneficiaries, there is emphasis on at least 30% female participation. There is need for the subproject dealing with legume utilization to target the same farmers, women included who are direct project beneficiaries of the legume dissemination technology.
Additional important information about the technology	Linking farmers to seed multiplication team and exiting markets by agro-processors dealing edible oil production are ready to take all the soybeans volume as demand is more than the current country production.
Contact details of the generators and promotors of the technology	IIAM-CZnd (Nampula) Email address: mcdonca2001@gmail.com Mobile: +258-84-52-95-565, +258-82-60-03-503 Country: Mozambique

2.5.2.3 Pigeon pea variety: ICEAP 01514/15 (Chitedze PP1)

Title of the technology or innovation	Improved medium duration pigeon pea variety: ICEAP 01514/15 (Chitedze PP1)
Description of the technology	ICEAP 01514/15 (Chitedze PP1) is green stem variety which matures in 180 days, yields up to 2.5 ton/ha-1 and is tolerant to fusarium wilt. ICEAP 01514/15 is smaller seeded than ICEAP 00557 and ICEAP 01485/3

End users of the technology	The users of the technologies are small-scale farmers as per recommended regions. Other users include seed companies, processors, grain traders. These varieties are used for direct human consumption, the animal feed industry and confectionary industry
Critical and essential factors for successful promotion and adoption of the technology	Seeds availability, accessibility and affordability are critical for successful promotion and adoption of the technology. Capacity of extension staff, availability of credit support through farmers' groups/cooperatives, and availability of extension services (public and private) are also key in stimulating adoption. These should be coupled with correct use of an appropriate extension delivery mechanism such as the dissemination through the private sector, NGOs, government extension service and decentralization of seed certification services (licensing of seed inspectors/samplers and laboratories).
Challenges encountered in respect to further dissemination of the technology, adoption and up/out scaling	Inadequate basic seed, drought, quality of extension messages, poor communication amongst various stakeholders, recycling of seed and negative mind set and altitudes of the key players (farmers and service providers) were the key challenges in adoption and out scaling of the technology.
Recommendations for addressing the challenges listed above	It is recommended that more basic seed be produced and made available for use, avail irrigation facilities to facilitate production of basic seed and engagement in contract farming for basic seed, and intensify promotional activities for the technologies to motivate farmers to be using good quality seed. There is also a need to improve on communication channels through establishing innovation platforms for information sharing. Packaging of appropriate extension messages to the users and use of appropriate channels including the creation of strong linkages and partnerships in the seed value chain are also necessary in addressing the seed scarcity and technology adoption bottlenecks.
Lessons learnt on the best ways for addressing the challenges listed above	Creating awareness of the technology through oral means, brochures, demonstration plots etc can improve technology uptake and through use of innovation platforms. Use of lead farmers to encourage farmer to farmer extension Regular training of farmers and farmer exchange visits are important in technology dissemination

Gender concern in the development and dissemination of the technology	Gender consideration in terms of labour required in the production of legumes and who benefits needs to be addressed. Although training was implemented to the disseminators and deliberate measures were taken to ensure equity in assess of the technologies, it was important that social barriers to both gender accessing these technologies were addressed
Additional important information about the technology	The technologies are promoted to raise farmers' incomes through seed sales to the direct beneficiaries. However, the technologies have many other benefits to the consumers in improving their nutritional status
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2.5.2.4 Pigeon pea variety: ICEAP 011485/3 (Chitedze PP2)

Title of the technology or innovation	Improved medium duration pigeon pea variety: ICEAP 011485/3 (Chitedze PP2)
Description of the technology	ICEAP 011485/3 (Chitedze PP2) matures in 180 days, yields up to 2.5 ton/ha-1 and is tolerant to fusarium wilt. The stem colour is green. It produced larger seeds and matures two weeks earlier than ICEAP 01514/15.
End users of the technology	The users of the technologies are small-scale farmers as per recommended regions. Other users include seed companies, processors, grain traders. These varieties are used for direct human consumption, the animal feed industry and confectionary industry

Critical and essential factors for successful promotion and adoption of the technology	Seeds availability and accessibility through seed multipliers and affordability of seed by small scale farmers Capacity of extension staff to sensitize farmers on the profitability of the crop and other nutritional benefits. Availability of credit support through farmers' groups/ cooperatives, Availability of extension services (public and private). The correct use of an appropriate delivery mechanism such as the dissemination through the private sector, NGOs, government extension service. decentralization of seed certification services (licensing of seed inspectors/samplers and laboratories)
Challenges encountered in respect to further dissemination of the technology, adoption and up/out scaling	inadequate basic seed, Droughts, quality of extension messages, Communication between various stakeholders, Recycling of seed competing with certified seed, Mind set and altitudes of the key players (farmers and service providers).
Recommendations for addressing the challenges listed above	Produce more basic seed and make them available for use, avail irrigation facilities to facilitate production of basic seed and engagement in contract farming for basic seed intensifying promotional activities for the technologies to motivate farmers use good quality seed Improve on communication channels through establishing innovation platforms for information sharing Packaging of appropriate extension messages to the users and use of appropriate channels Creation of strong linkages and partnerships in the seed value chain
Lessons learnt on the best ways for addressing the challenges listed above	Conduct forward planning Creating awareness of the technology through oral means, brochures, demonstration plots etc can improve technology uptake and through use of innovation platforms Use of lead farmers to encourage farmer to farmer extension Regular training of farmers and farmer exchange visits are important in technology dissemination

Gender concern in the development and dissemination of the technology	Gender consideration in terms of labour required in the production of legumes and who benefits needs to be addressed. Although training was implemented to the disseminators and deliberate measures were taken to ensure equity in assess of the technologies, it was important that social barriers to both gender accessing these technologies were addressed
Additional important information about the technology	The technologies are promoted to raise farmers' incomes through seed sales to the direct beneficiaries. However, the technologies have many other benefits to the consumers in improving their nutritional status
Contact details of the generators and promotors of the technology	Seed Control and Certification Institute, P.O. Box 350199, Chilanga, nathpzm@yahoo.co.uk/natanphiri@gmail.com Telephone: +260 211 278236 Mobile: +260 973500965/+260964867043, Country: Zambia Zambia Agriculture Research Institute, P/Bag 7, Chilanga Email address: zaridirector@zari.gov.zm or mwalemp@yahoo.com, Telephone: +260 211 278130, Mobile: +260 966 766395, Country: Zambia

2.6 Soybean technologies

2.6.1 Medium duration disease resistant soybean Varieties

2.6.1.1 Soybean Variety: TGX 1908-8F

Title of the technology or innovation	Medium duration disease resistant soybean Variety: TGX 1908-8F
Description of the technology	This is a median maturity variety, with yield potential up to 2.5 tons/ha. It is resistance to important diseases, such as rust and soil borne diseases.
End users of the technology	Commercial and smallholder farmers in Mozambique and in the SADC region.
Critical and essential factors for successful promotion and adoption of the technology	Availability, accessibility and affordability of seen are critical factors for successful promotion of the variety. Seed can be made available through seed multipliers such as public and private seed companies, farmer groups and farmer research networks. Good markets, existence of strong farmers' organizations; credit support and extension services (public and private) and availability of the intermediaries that can buy from the farmers are all stimulants to adoption of the technology.
Challenges encountered in respect to further dissemination of the technology, adoption and up/out scaling	Low seed multiplication and low capacity of extension officers in sensitization of the technology were the main challenges encountered. There was also a high risk of contamination because the variety is open pollinated as such require isolation distance.
Recommendations for addressing the challenges listed above	Extension officers are crucial stakeholders in dissemination/ scaling up of the technology. Engagement of Farmers Groups producing seed for local commercialization, and engagement of extension offices in promotional campaigns need to be encouraged.
Lessons learnt on the best ways for addressing the challenges listed above	Creating awareness of the technology through oral means, brochures, demonstration plots and farmer to farmer contacts can improve technology uptake. Regular trainings for farmers are important in technology dissemination.
Gender concern in the development and dissemination of the technology	None
Additional important information about the technology	None

Contact details of the generators and promotors of the technology	Seed Control and Certification Institute, P.O. Box 350199, Chilanga. nathpzm@yahoo.co.uk/natanphiri@gmail.com Telephone: +260 211 278236,Mobile: +260 973500965/+260964867043 Country: Zambia Zambia Agriculture Research Institute, P/Bag 7, Chilanga, Email address: zaridirector@zari.gov.zm or mwalemp@yahoo.com +260 211 278130 Mobile: +260 966 766395 Country: Zambia

2.6.1.2 Soybean variety: TGX 1740-2F

Title of the technology or innovation	Medium maturing and resistant to multiple diseases soybean variety: TGX 1740-2F
Description of the technology	TGX 1740-2F is a median maturity variety, with yield potential of up to 2.5 tons/ha. It is resistant to important diseases, such as rust and soil borne diseases.
End users of the technology	Commercial and smallholder farmers in Mozambique and in the SADC region.
Critical and essential factors for successful promotion and adoption of the technology	Availability, accessibility and affordability of seen are critical factors for successful promotion of the variety. Seed can be made available through seed multipliers such as public and private seed companies, farmer groups and farmer research networks. Good markets, existence of strong farmers' organizations; credit support and extension services (public and private) and availability of the intermediaries that can buy from the farmers are all stimulants to adoption of the technology.
Challenges encountered in respect to further dissemination of the technology, adoption and up/out scaling	Low seed multiplication and low capacity of extension officers in sensitization of the technology were the main challenges encountered. There was also a high risk of contamination because the variety is open pollinated as such require isolation distance.

Recommendations for addressing the challenges listed above	Extension officers are crucial stakeholders in dissemination/ scaling up of the technology. Engagement of Farmers Groups producing seed for local commercialization, and engagement of extension offices in promotional campaigns need to be encouraged.
Lessons learnt on the best ways for addressing the challenges listed above	Creating awareness of the technology through oral means, brochures, demonstration plots and farmer to farmer contacts can improve technology uptake. Regular trainings for farmers are important in technology dissemination.
Gender concern in the developmentanddissemination of the technology	None
Additional important information about the technology	None
Contact details of the generators and promotors of the technology	Seed Control and Certification Institute, P.O. Box 350199, Chilanga. nathpzm@yahoo.co.uk/natanphiri@gmail.com Telephone: +260 211 278236,Mobile: +260 973500965/+260964867043 Country: Zambia Zambia Agriculture Research Institute, P/Bag 7, Chilanga, Email address: zaridirector@zari.gov.zm or mwalemp@yahoo.com +260 211 278130 Mobile: +260 966 766395 Country: Zambia

2.6.1.3 Soybean variety – Lukanga

Title of the technology or innovation	Medium maturing soybean variety tolerant to major pests and diseases – Lukanga
Description of the technology	Lukanga is an early to medium maturing variety (115days after planting) with yield potential of between 4 to 5tons/ha. The variety has determinate growth habit and grows to the height of between 90 and 100cm. The grain is white with colorless hilum while the stem contains white hair. It has large seed size weighing about 24grams per 100 seeds. The variety responds to inoculum application and grows well in sand loamy soils to heavy clay soils. Its tolerant to major soybean diseases and insect pests.
End users of the technology	The users of the technologies are small-scale farmers as per recommended regions. Other users include seed companies, processors and grain traders. This variety is used for direct human consumption, in animal feed industry and in confectionary industry.
Critical and essential factors for successful promotion and adoption of the technology	Seeds availability, accessibility and affordability are important factors for the promotion of the technology. Engagement of seed multipliers is one of the factors that can drive the availability of the seed. Capacity of extension staff to sensitive farmers on the profitability of the crop and other nutritional benefits is also key to technology promotion. Other key areas for technology adoption are (i) availability of credit support through farmers' groups/ cooperatives, (ii) availability of extension services (public and private), (iii) the correct use of an appropriate delivery mechanism such as the dissemination through the private sector, NGOs, government extension service, and (iv) decentralization of seed certification services (licensing of seed inspectors/samplers and laboratories).

Figure 22: Lukanga soybean variety

Challenges encountered in respect to further dissemination of the technology, adoption and up/out scaling	Inadequate basic seed, droughts, poor quality of extension messages, poor communication amongst various stakeholders, recycling of seed, mind set and altitudes of the key players (farmers and service providers) were the main challenges encountered during technology dissemination.
Recommendations for addressing the challenges listed above	Sin order to address the challenges in technology dissemination the following actions are recommended: • Produce more basic seed and make them available for use. • Avail irrigation facilities to facilitate production of basic seed and engagement in contract farming for basic seed. • Intensifying promotional activities for the technologies to motivate farmers use good quality seed. • Improve on communication channels through establishing innovation platforms for information sharing. • Packaging of appropriate extension messages to the users and use of appropriate channels • Creation of strong linkages and partnerships in the seed value chain
Lessons learnt on the best ways for addressing the challenges listed above	Creating awareness of the technology through oral means, brochures, farmer exchange visits, demonstration plots and through use of innovation platforms can improve technology uptake. Secondly, the use of lead farmers to encourage farmer to farmer extension are also important in technology dissemination.
Gender concern in the development and dissemination of the technology	There is a need to address gender roles in the production of legumes and the utilization benefits to ensure equality and equity. It is important to break social barriers to both gender groups in accessing the technology.
Additional important information about the technology	The technology is promoted to raise farmers' incomes through seed sales. However, the technology might have other benefits to the consumers in improving their nutritional status

Contact details of the generators and promotors of the technology	Seed Control and Certification Institute, P.O. Box 350199, Chilanga. nathpzm@yahoo.co.uk/natanphiri@gmail.com Telephone: +260 211 278236,Mobile: +260 973500965/+260964867043 Country: Zambia Zambia Agriculture Research Institute, P/Bag 7, Chilanga, Email address: zaridirector@zari.gov.zm or mwalemp@yahoo.com +260 211 278130 Mobile: +260 966 766395 Country: Zambia

2.6.2 Processed soybean nutritional products

2.6.2.1 Soymilk

Title of the technology or innovation	Soymilk,
Description of the technology	Extraction of legume milk makes soybeans to be a crop that can be consumed at household level unlike being a commercial crop only.
End users of the technology	Farmers, extension agents and small and medium enterprises
Critical and essential factors for successful promotion and adoption of the technology	Soybean has high nutritive value and is a low-cost source of protein for smallholder farmers. There is low utilization and awareness of the benefits of processing soybeans into various products among farmers.
Challenges encountered in respect to further dissemination of the technology, adoption and up/out scaling	Low awareness and low utilization of soybean as soymilk
Recommendations for addressing the challenges listed above	Improvement on the publicity of the utilization of soybean as soymilk
Lessons learnt on the best ways for addressing the challenges listed above	Increasing awareness among end users of the technology

Gender concern in the development and dissemination of the technology	There should be gender targeting to increase the level of awareness on the utilization of soymilk. Cooking is generally considered to be an activity for women; but gender balance in the utilization of soybeans can help in increasing utilization and household level.
Additional important information about the technology	Other legume crops should be considered for utilization as well.
Contact details of the generators and promotors of the technology	Ndashe Kapulu (PI) Zambia Agriculture Research Institute, Mt. Makulu Research Station, Chilanga, Zambia +260 977 417221 ndacho81@yahoo.co.uk

2.6.2.2 Soy Relish

Title of the technology or innovation	Soy Relish
Description of the technology	Production of vegan food makes soybeans to be a crop that can be consumed at household level unlike being a commercial crop only.
End users of the technology	Farmers, extension agents and small and medium enterprises
Critical and essential factors for successful promotion and adoption of the technology	Soybean has high nutritive value and is a low-cost source of protein for smallholder farmers. There is low utilization and awareness of the benefits of processing soybeans into various products among farmers.
Challenges encountered in respect to further dissemination of the technology, adoption and up/out scaling	Low awareness and low utilization of soybean as Soy Relish
Recommendations for addressing the challenges listed above	Improvement on the publicity of the utilization of soybean as Soy Relish
Lessons learnt on the best ways for addressing the challenges listed above	Increasing awareness among end users of the technology

Gender concern in the development and dissemination of the technology	There should be gender targeting to increase the level of awareness on the utilization of Soy Relish. Cooking is generally considered to be an activity for women; but gender balance in the utilization of soybeans can help in increasing utilization and household level.
Additional important information about the technology	Other legume crops should be considered for utilization as well.
Contact details of the generators and promotors of the technology	Ndashe Kapulu (PI) Zambia Agriculture Research Institute, Mt. Makulu Research Station, Chilanga, Zambia +260 977 417221 ndacho81@yahoo.co.uk

2.6.2.3 Soy bakery products

Title of the technology or innovation	Soy bakery products
Description of the technology	Incorporation of soybean into bakery products makes soybeans to be a crop that can be consumed at household level unlike being a commercial crop only.
End users of the technology	Farmers, extension agents and small and medium enterprises
Critical and essential factors for successful promotion and adoption of the technology	Soybean has high nutritive value and is a low-cost source of protein for smallholder farmers. There is low utilization and awareness of the benefits of processing soybeans into various products among farmers.
Challenges encountered in respect to further dissemination of the technology, adoption and up/out scaling	Low awareness and low utilization of soybean as Soy bakery products
Recommendations for addressing the challenges listed above	Improvement on the publicity of the utilization of soybean as Soy bakery products
Lessons learnt on the best ways for addressing the challenges listed above	Increasing awareness among end users of the technology

Gender concern in the development and dissemination of the technology	There should be gender targeting to increase the level of awareness on the utilization of Soy bakery products. Cooking is generally considered to be an activity for women; but gender balance in the utilization of soybeans can help in increasing utilization and household level.
Additional important information about the technology	Other legume crops should be considered for utilization as well.
Contact details of the generators and promotors of the technology	Ndashe Kapulu (PI) Zambia Agriculture Research Institute, Mt. Makulu Research Station, Chilanga, Zambia +260 977 417221 ndacho81@yahoo.co.uk

3.0 TECHNOLOGIES FOR RICE AND RICE-BASED SYSTEMS

3.1 Aromatic high yielding rice seed delivery system

3.1.1 Rice variety -Supa

Title of the technology or innovation	Aromatic high yielding rice seed delivery system-Supa
Description of the technology	Supa is a very aromatic and marketable paddy rice variety, developed with the participation of farmers. The plants grow up to 1 meter tall and have large panicles. It is a high yielding variety with the yield potential of up to 5tons per hectare. Supa variety matures in about 120 days and is tolerant to blast and sheath blight. However, the variety shatters in the field especially when too dry.
End users of the technology	The users of the technology are small-scale farmers in rice growing zones of western province, northern, Luapula, north western and eastern provinces of Zambia. Other users include large- and small-scale rice processors, agro-dealers, rice traders and emerging seed companies.
Critical and essential factors for successful promotion and adoption of the technology	Availability and accessibility of seed through seed multipliers such as private seed companies and farmer groups is necessary for the promotion of the technology. Accessibility of seed to the users of the technology can be facilitated by promoting efficient seed distribution system at affordable prices to ensure profitability of the adopted technology. Existence of strong farmers' organizations, availability of credit support through farmers' groups/cooperatives and availability of extension services (public and private) are amongst the factors that are critical in promoting technology adoption.
Challenges encountered in respect to further dissemination of the technology, adoption and up/out scaling	Untimely release of funds, inadequate basic seed, drought and poor quality of extension messages were the challenges encountered during dissemination of the technologies. In addition, most rice growing areas had poor infrastructure which gave serious accessibility challenges.
Recommendations for addressing the challenges listed above	Putting up mechanisms that facilitate timely disbursement of research funds is recommended. It is also recommended that more basic be produced and this can be done by availing irrigation facilities for use in seed production. Policy lobbying for better infrastructure is also necessary.

Lessons learnt on the best ways for addressing the challenges listed above	Creating awareness of the technology through oral means, brochures, farmer to farmer visits and demonstration plots can improve technology uptake and therefore should be encouraged. Regular training of farmers is also important in technology dissemination.
Gender concern in the developmentanddissemination of the technology	There is a need to do gender analysis in terms of labour distribution and benefits sharing during production and postharvest processing of rice.
Additional important information about the technology	None
Contact details of the generators and promotors of the technology	Seed Control and Certification Institute, P.O. Box 350199, Chilanga nathpzm@yahoo.co.uk/natanphiri@gmail.com Telephone: +260 211 278236, Mobile: +260 973500965 /+260964867043 Country: Zambia Zambia Agriculture Research Institute, P/Bag 7, Chilanga Email address: zaridirector@zari.gov.zm or mwalemp@yahoo.com, Telephone: +260 211 278130, Mobile: +260 966 766395, Country: Zambia

3.1.2 Rice variety – Kilombero

Title of the technology or innovation	Aromatic long grain rice variety - Kilombero
Description of the technology	A Kilombero is the aromatic rice variety which Zambia adopted from Malawi. It is a paddy rice variety with long grains.
End users of the technology	The users of the technology are small scale farmers in rice growing zones of western province, northern, Luapula, north western and eastern provinces of Zambia. Other users include large- and small-scale rice processors, agro-dealers, rice traders and emerging seed companies.

Critical and essential factors for successful promotion and adoption of the technology	Availability and accessibility of seed through seed multipliers such as private seed companies and farmer groups is necessary for the promotion of the technology. Accessibility of seed to the users of the technology can be facilitated by promoting efficient seed distribution system at affordable prices to ensure profitability of the adopted technology. Existence of strong farmers' organizations, availability of credit support through farmers' groups/cooperatives and availability of extension services (public and private) are amongst the factors that are critical in promoting technology adoption.
Challenges encountered in respecttofurtherdissemination of the technology, adoption and up/out scaling	Untimely release of funds, inadequate basic seed, drought and poor quality of extension messages were the challenges encountered during dissemination of the technologies. In addition, most rice growing areas had poor infrastructure which gave serious accessibility challenges.
Recommendations for addressing the challenges listed above	Putting up mechanisms that facilitate timely disbursement of research funds is recommended. It is also recommended that more basic be produced and this can be done by availing irrigation facilities for use in seed production. Policy lobbying for better infrastructure is also necessary.
Lessons learnt on the best ways for addressing the challenges listed above	Putting up mechanisms that facilitate timely disbursement of research funds is recommended. It is also recommended that more basic be produced and this can be done by availing irrigation facilities for use in seed production. Policy lobbying for better infrastructure is also necessary
Gender concern in the development and dissemination of the technology	There is a need to do gender analysis in terms of labour distribution and benefits sharing during production and postharvest processing of rice.
Additional important information about the technology	None
Contact details of the generators and promotors of the technology	Seed Control and Certification Institute, P.O. Box 350199, Chilanga nathpzm@yahoo.co.uk/natanphiri@gmail.com Telephone: +260 211 278236, Mobile: +260 973500965 /+260964867043 Country: Zambia Zambia Agriculture Research Institute, P/Bag 7, Chilanga Email address: zaridirector@zari.gov.zm or mwalemp@yahoo.com, Telephone: +260 211 278130, Mobile: +260 966 766395, Country: Zambia

3.1.3 Rice variety - Nerica 1

Title of the technology or innovation	Aromatic early maturing rice variety - Nerica 1
Description of the technology	Nerica 1 is an aromatic long grain rice, released in Zambia as upland rice but was adopted from west Africa. It is an early maturing variety (105 days after planting) and is resistant to most rice diseases
End users of the technology	The users of the technology are small-scale farmers in rice growing zones of western province, northern, Luapula, north western and eastern provinces of Zamnbia. Other users include large- and small-scale rice processors, agro-dealers, rice traders, emerging seed companies.
Critical and essential factors for successful promotion and adoption of the technology	Availability and accessibility of seed through seed multipliers such as private seed companies and farmer groups is necessary for the promotion of the technology. Accessibility of seed to the users of the technology can be facilitated by promoting efficient seed distribution system at affordable prices to ensure profitability of the adopted technology. Existence of strong farmers' organizations, availability of credit support through farmers' groups/cooperatives and availability of extension services (public and private) are amongst the factors that are critical in promoting technology adoption.
Challenges encountered in respect to further dissemination of the technology, adoption and up/out scaling	Untimely release of funds, inadequate basic seed, drought and poor quality of extension messages were the challenges encountered during dissemination of the technologies. In addition, most rice growing areas had poor infrastructure which gave serious accessibility challenges.
Recommendations for addressing the challenges listed above	Putting up mechanisms that facilitate timely disbursement of research funds is recommended. It is also recommended that more basic be produced and this can be done by availing irrigation facilities for use in seed production. Policy lobbying for better infrastructure is also necessary.
Lessons learnt on the best ways for addressing the challenges listed above	Creating awareness of the technology through oral means, brochures, demonstration plots and farmer extension can improve technology uptake and should be encouraged. Regular training of farmers and farmer exchange visits are also important in technology dissemination

Gender concern in the development and dissemination of the technology	There is a need to do gender analysis in terms of labour distribution and benefits sharing during production and postharvest processing of rice.
Additional important information about the technology	None
Contact details of the generators and promotors of the technology	Seed Control and Certification Institute, P.O. Box 350199, Chilanga nathpzm@yahoo.co.uk/natanphiri@gmail.com Telephone: +260 211 278236, Mobile: +260 973500965 /+260964867043 Country: Zambia Zambia Agriculture Research Institute, P/Bag 7, Chilanga Email address: zaridirector@zari.gov.zm or mwalemp@yahoo.com, Telephone: +260 211 278130, Mobile: +260 966 766395, Country: Zambia

3.1.4 Rice variety- Nene

Title of the technology or innovation	Aromatic and highly marketable rice variety- Nene
Description of the technology	Nene yields 4 ton/ha, matures in between 97-122 days, is a very aromatic and highly marketable variety.
End users of the technology	The users of the technology are smallholder farmers in 4 provinces of Zambia. Extension officers and researchers also use the variety.
Critical and essential factors for successful promotion and adoption of the technology	Availability of the pure seed of the variety is key towards successful promotion and adoption of the variety.
Challenges encountered in respect to further dissemination of the technology, adoption and up/out scaling	Ex-situ conservation infrastructure and equipment for molecular characterization were not available during technology generation and dissemination.
Recommendations for addressing the challenges listed above	There is a need to build capacity of staff in the area of germplasm screening.

Lessons learnt on the best ways for addressing the challenges listed above	Effective collaboration project partners allowed sharing of human and financial resources and facilities.
Gender concern in the development and dissemination of the technology	None
Additional important information about the technology	None
Contact details of the generators and promotors of the technology	Paulino Munisse, IIAM Email address: pmunisse@gmail.com Telephone: 258 21 460190 Country: Mozambique

3.1.5 Rice variety – Mocuba

Title of the technology or innovation	Aromatic and disease resistant rice variety - Mocuba
Description of the technology	Mocuba yields 6.8 ton/ha; matures in 153 days; is aromatic and resistant to diseases.
End users of the technology	The users of the technology are smallholder farmers in 4 provinces of Zambia. Extension officers and researchers also use the variety.
Critical and essential factors for successful promotion and adoption of the technology	Availability of the pure seed of the variety is key towards successful promotion and adoption of the variety.
Challenges encountered in respect to further dissemination of the technology, adoption and up/out scaling	Ex-situ conservation infrastructure and equipment for molecular characterization were not available during technology generation and dissemination.
Recommendations for addressing the challenges listed above	There is a need to build capacity of staff in the area of germplasm screening.
Lessons learnt on the best ways for addressing the challenges listed above	Effective collaboration project partners allowed sharing of human and financial resources and facilities.

Gender concern in the development and dissemination of the technology	None
Additional important information about the technology	None
Contact details of the generators and promotors of the technology	Paulino Munisse, IIAM Email address: pmunisse@gmail.com Telephone: 258 21 460190 Country: Mozambique

3.2 Short duration, non-sticky rice variety

3.2.1 Rice variety – Nerica 4

Title of the technology or innovation	Short duration, non-sticky rice variety - Nerica 4
Description of the technology	Nerica 4 is a dwarf (80cm), short duration (110-115 days) and non-aromatic upland rice with the potential yield of 4-5tons/ha. It The gains are of medium size and non-sticky when cooked. The variety is adaptable to all rice growing areas and has very good resistance to common diseases of rice.
End users of the technology	The users of the technology are small scale farmers in rice growing zones of western province, northern, Luapula, North western and eastern provinces of Zambia. Other users include large- and small-scale rice processors, agro-dealers, rice traders and emerging seed companies
Critical and essential factors for successful promotion and adoption of the technology	Availability and accessibility of seed through seed multipliers such as private seed companies and farmer groups is necessary for the promotion of the technology. Accessibility of seed to the users of the technology can be facilitated by promoting efficient seed distribution system at affordable prices to ensure profitability of the adopted technology. Existence of strong farmers' organizations, availability of credit support through farmers' groups/cooperatives and availability of extension services (public and private) are amongst the factors that are critical in promoting technology adoption.

Challenges encountered in respect to further dissemination of the technology, adoption and up/out scaling	Untimely release of funds, inadequate basic seed, drought and poor quality of extension messages were the challenges encountered during dissemination of the technologies. In addition, drought and inadequate extension services negatively affected technology dissemination.
Recommendations for addressing the challenges listed above	Putting up mechanisms that facilitate timely disbursement of research funds is recommended. It is also recommended that more basic be produced and this can be done by availing irrigation facilities for use in seed production. Policy lobbying for better infrastructure is also necessary
Lessons learnt on the best ways for addressing the challenges listed above	Creating awareness of the technology through oral means, brochures, demonstration plots and farmer extension can improve technology uptake and should be encouraged. Regular training of farmers and farmer exchange visits are also important in technology dissemination
Gender concern in the development and dissemination of the technology	There is a need to do gender analysis in terms of labour distribution and benefits sharing during production and postharvest processing of rice.
Additional important information about the technology	None
Contact details of the generators and promotors of the technology	Seed Control and Certification Institute, P.O. Box 350199, Chilanga nathpzm@yahoo.co.uk/natanphiri@gmail.com Telephone: +260 211 278236, Mobile: +260 973500965 /+260964867043 Country: Zambia Zambia Agriculture Research Institute, P/Bag 7, Chilanga Email address: zaridirector@zari.gov.zm or mwalemp@yahoo.com, Telephone: +260 211 278130, Mobile: +260 966 766395, Country: Zambia

3.3 High yielding rice variety

3.3.1 Rice variety- Macassane

Title of the technology or innovation	High yielding rice variety- Macassane

Description of the technology	Macassane is a high yielding rice variety (10.0 tons/ha) which matures in 133 days, has long grain and tastes good. It has erect growth habit and grows up to 87cm high. It is resistant to storage pest.
End users of the technology	The main users of the technology are smallholder farmers in the four (4) provinces of Zambia. The variety is also used by extension officers and researchers.
Critical and essential factors for successful promotion and adoption of the technology	Availability of the pure seed of the variety is key towards successful promotion and adoption of the variety.
Challenges encountered in respect to further dissemination of the technology, adoption and up/out scaling	Ex-situ conservation infrastructure and equipment for molecular characterization were not available during technology generation and dissemination.
Recommendations for addressing the challenges listed above	There is a need to build capacity of staff in the area of germplasm screening.
Lessons learnt on the best ways for addressing the challenges listed above	Effective collaboration with project partners allowed sharing of human and financial resources and facilities.
Gender concern in the development and dissemination of the technology	None
Additional important information about the technology	None
Contact details of the generators and promotors of the technology	Paulino Munisse, IIAM Email address: pmunisse@gmail.com Telephone: 258 21 460190 Country: Mozambique

3.3.2 Rice variety- Mdziva

Title of the technology or innovation	High yielding rice variety- Mdziva

Description of the technology	Mdziva is a high yielding variety (6.2 tons/ha), take 125 days to mature, has long grain and good taste. It has erect growth with compact panicle, grows up to 87cm high and constitute 84% industrial yield.
End users of the technology	The users of the technology are smallholder farmers in 4 provinces of Zambia. Extension officers and researchers also use the variety.
Critical and essential factors for successful promotion and adoption of the technology	Availability of the pure seed of the variety is key towards successful promotion and adoption of the variety.
Challenges encountered in respect to further dissemination of the technology, adoption and up/out scaling	Ex-situ conservation infrastructure and equipment for molecular characterization were not available during technology generation and dissemination.
Recommendations for addressing the challenges listed above	There is a need to build capacity of staff in the area of germplasm screening.
Lessons learnt on the best ways for addressing the challenges listed above	Effective collaboration project partners allowed sharing of human and financial resources and facilities.
Gender concern in the development and dissemination of the technology	None
Additional important information about the technology	None
Contact details of the generators and promotors of the technology	Paulino Munisse, IIAM Email address: pmunisse@gmail.com Telephone: 258 21 460190 Country: Mozambique

3.3.3. Rice variety- Limpoto

Title of the technology or innovation	High yielding rice variety- Limpoto
Description of the technology	Limpopo is a high yielding variety (6.2 tons/ha), matures in 125 days, has long grains, and tastes good.

End users of the technology	The users of the technology are smallholder farmers in 4 provinces of Zambia. Extension officers and researchers also use the variety.
Critical and essential factors for successful promotion and adoption of the technology	Availability of the pure seed of the variety is key towards successful promotion and adoption of the variety.
Challenges encountered in respect to further dissemination of the technology, adoption and up/out scaling	Ex-situ conservation infrastructure and equipment for molecular characterization were not available during technology generation and dissemination.
Recommendations for addressing the challenges listed above	There is a need to build capacity of staff in the area of germplasm screening.
Lessons learnt on the best ways for addressing the challenges listed above	Effective collaboration project partners allowed sharing of human and financial resources and facilities.
Gender concern in the development and dissemination of the technology	None
Additional important information about the technology	None
Contact details of the generators and promotors of the technology	Paulino Munisse, IIAM Email address: pmunisse@gmail.com Telephone: 258 21 460190 Country: Mozambique

3.3.4 Rice variety- ITA-312

Title of the technology or innovation	High yielding rice variety- ITA-312
Description of the technology	ITA-312 is a high yielding variety (8.0 tons/ha), matures in 136 days and has long grains
End users of the technology	The users of the technology are smallholder farmers in 4 provinces of Zambia. Extension officers and researchers also use the variety.

Critical and essential factors for successful promotion and adoption of the technology	Availability of the pure seed of the variety is key towards successful promotion and adoption of the variety.
Challenges encountered in respect to further dissemination of the technology, adoption and up/out scaling	Ex-situ conservation infrastructure and equipment for molecular characterization were not available during technology generation and dissemination.
Recommendations for addressing the challenges listed above	There is a need to build capacity of staff in the area of germplasm screening.
Lessons learnt on the best ways for addressing the challenges listed above	Effective collaboration project partners allowed sharing of human and financial resources and facilities.
Gender concern in the development and dissemination of the technology	None
Additional important information about the technology	None
Contact details of the generators and promotors of the technology	Paulino Munisse, IIAM Email address: pmunisse@gmail.com Telephone: 258 21 460190 Country: Mozambique

3.3.5 Rice variety- Simao

Title of the technology or innovation	High yielding rice variety- Simao
Description of the technology	Simão yields 10.0 tons/ha, matures in 133 days and has long grains.
End users of the technology	The users of the technology are smallholder farmers in 4 provinces of Zambia. Extension officers and researchers also use the variety.
Critical and essential factors for successful promotion and adoption of the technology	Availability of the pure seed of the variety is key towards successful promotion and adoption of the variety.

Challenges encountered in respect to further dissemination of the technology, adoption and up/out scaling	Ex-situ conservation infrastructure and equipment for molecular characterization were not available during technology generation and dissemination.
Recommendations for addressing the challenges listed above	There is a need to build capacity of staff in the area of germplasm screening.
Lessons learnt on the best ways for addressing the challenges listed above	Effective collaboration project partners allowed sharing of human and financial resources and facilities.
Gender concern in the development and dissemination of the technology	None
Additional important information about the technology	None
Contact details of the generators and promotors of the technology	Paulino Munisse, IIAM Email address: pmunisse@gmail.com Telephone: 258 21 460190 Country: Mozambique

4.0 TECHNOLOGIES FOR SORGHUM AND SORGHUM-BASED SYSTEMS

4.1 High yielding and drought tolerant sorghum variety

4.1.1 Sorghum variety: Kuyuma

Title of the technology or innovation	High yielding and drought resistant sorghum variety: Kuyuma
Description of the technology	Kuyuma is an early maturing, short variety which produces white grains which have good milling properties. It is widely adapted to low rainfall areas with good resistance to most diseases in Zambia except for anthracnose. The variety has been evaluated in Tanzania, Mozambique, Zimbabwe and Botswana with successful results.
End users of the technology	The users of technology are small scale farmers as well as commercial farmers. Smallholder farmers, particularly those that cultivate in drought prone areas benefit from this variety due to its ability to withstand drought.
Critical and essential factors for successful promotion and adoption of the technology	Accessible seeds through agro dealers and access to extension services amongst farmers are critical in promoting the variety.
Challenges encountered in respect to further dissemination of the technology, adoption and up/out scaling	Poor market linkages amongst growers, buyers and processors. The value chain of the product from production to consumption is not well coordinated as such farmers have been accessing poor and exploitative markets.
Recommendations for addressing the challenges listed above	There is a need to make the value chain active and functional.
Lessons learnt on the best ways for addressing the challenges listed above	Awareness and participation in commodity value chain is key towards promoting access to better markets which in turn stimulates production and adoption of the technology.
Gender concern in the development and dissemination of the technology	None

Additional important information about the technology	Limit the number of technologies that a lead farmer explains to other farmers to two.
Contact details of the generators and promotors of the technology	ZARI, Mount Makulu Central Research Station P/B 7 Chilanga Email: zaridirector@zari.gov.zm Telephone: (211) 278380 / 278141 Country: Zambia

4.2 Drought and per-harvest pests tolerant sorghum varieties

4.2.1 Sorghum variety: ZSV 36 R

Title of the technology or innovation	Drought and per-harvest pests tolerant sorghum variety: ZSV 36 R
Description of the technology	ZSV 36 R is an early maturing and short variety with red grains. It is variety suitable for food (porridge) and brewing. It is widely adapted to low rainfall areas. Yield losses due to bird damage are minimal. Birds shun the grain because of the bitter tannins in the seed coat.
End users of the technology	The users of technology are small scale farmers as well as commercial farmers
Critical and essential factors for successful promotion and adoption of the technology	Accessible seeds through agro dealers and access to extension services amongst farmers are critical in promoting the variety.
Challenges encountered in respect to further dissemination of the technology, adoption and up/out scaling	Poor market linkages amongst growers, buyers and processors. The value chain of the product from production to consumption is not well coordinated as such farmers have been accessing poor and exploitative markets.
Recommendations for addressing the challenges listed above	There is a need to make the value chain active and functional.
Lessons learnt on the best ways for addressing the challenges listed above	Awareness and participation in commodity value chain is key towards promoting access to better markets which in turn stimulates production and adoption of the technology.
Gender concern in the development and dissemination of the technology	None

Additional important information about the technology	Limit the number of technologies that a lead farmer explains to other farmers to two.
Contact details of the generators and promotors of the technology	ZARI, Mount Makulu Central Research Station P/B 7 Chilanga Email: zaridirector@zari.gov.zm Telephone: (211) 278380 / 278141 Country: Zambia

5.0 SOIL FERTILITY MANAGEMENT TECHNOLOGIES

5.1 Use of Slurry inoculant in soybeans

Title of the technology or innovation	Inoculation of soybean with slurry inoculant
Description of the technology	Inoculation is the application of inoculum on the seed or the soil to enhance nodulation in legumes. The aim of inoculation is to initiate infection of the root nodules by a bacterium called **Bradyrhizobium japonicum** which fixes nitrogen for use by the plant and other plants. This consequently leads to an improvement in yield.
End users of the technology	Smallholder farmers, Research-Extension
Critical and essential factors for successful promotion and adoption of the technology	Strong Research-Extension Linkages, Intensified on-farm demonstrations
Challenges encountered in respect to further dissemination of the technology, adoption and up/out scaling	Limited farmer knowledge in use of pesticides/fungicides and fertilisers in legumes crop production. The promoted varieties not available for farmers though a lot of them have expressed interest.
Recommendations for addressing the challenges listed above	Training of field staff is needed to enhance understanding of the project. Farmer training on use of inoculants as well as safe disposal of containers of these live bacteria
Lessons learnt on the best ways for addressing the challenges listed above	Consistent farmer-extension interaction at all the dissemination forums is essential. Promotion should be intensified through electronic and print media for more farmers to be aware, but this calls for resources to be readily available
Gender concern in the development and dissemination of the technology	Use of sprayers has a connotation of masculine. Meaning the spraying of the chemicals is viewed as a man's job
Additional important information about the technology	The safeguards team needs to help the teams with safeguards measures concerning handling of the live bacteria and safe disposal of the containers

Contact details of the generators and promotors of the technology	Zambia Agriculture Research Institute Email address: zaridirector@zari.gov.zm or mwalemp@yahoo.com, Telephone: +260 211 278130 Mobile: +260 966 766395 Country: Zambia Department of Agriculture Email address: pklungu@yahoo.com Telephone: +260 211 252029 Mobile: +260 966 803868 Country: Zambia Department of Agriculture Email address: kabkaoma05@gmail.com Telephone: +260 211 223313 Mobile: +260 977891760 Country: Zambia

5.2 Use of D compound and ammonium nitrate fertilizers in sorghum production

Title of the technology or innovation	Use of D compound and ammonium nitrate fertilizers in sorghum production
Description of the technology	In Zambia most of the sorghum is grown without any fertilizer by small scale farmers leading to poor average yield of 677 kg/ha (MACO & CSO, 2009). The current recommendation of fertilizer for sorghum is a basal dressing of 200 kg/ha D compound with a top dressing of 100 kg/ha urea. When fertilizer is used with improved varieties, the average yield is raised above 2 t/ha.
End users of the technology	All categories of farmers
Critical and essential factors for successful promotion and adoption of the technology	Technology (fertilizer) is available through agro- dealers and cooperatives and is affordable due to government subsidies. There is capacity of extension staff to sensitize farmers on the profitability of using fertilizer. Fertilizer is accessible to farmers through agro- dealers and cooperatives which are present throughout the country. Both public and private extension services are available for dissemination.

Challenges encountered in respect to further dissemination of the technology, adoption and up/out scaling	Timeliness of application of fertilizer Availability of genuine fertilizer Affordability of fertilizer
Recommendations for addressing the challenges listed above	Effective planning for the farming calendar and acquisition of fertilizer
Lessons learnt on the best ways for addressing the challenges listed above	Awareness and participation in commodity value chain
Gender concern in the development and dissemination of the technology	None
Additional important information about the technology	The number of technologies that a lead farmer explains to other farmers should be limited to about two.
Contact details of the generators and promotors of the technology	ZARI, Mount Makulu Central Research Station P/B 7 Chilanga Email: zaridirector@zari.gov.zm Telephone: (211) 278380 / 278141 Country: Zambia

5.3 Use of Silicon Based Fertilizer in Maize and Rice Production

Title of the technology or innovation	Silicon Based Fertilizer
Description of the technology	Organic based (Rice Husk Biochar) and Geologic based (Phosphate rock-Silica sand-Diatomite) basal fertilizer for maize and upland rice. Liquid based stabilized silicic acid-boric acid-potassium silicate foliar fertilizer for a variety of crops
End users of the technology	The users of the technology are smallholder rain fed maize and rice farmers in region I of Zambia (Chama, Mambwe, Luangwa, Lusitu, Kazungula, Soma and Senanga Districts) and Southern (Chikwawa), Central (Salina) and Northern (Karenna) regions of Malawi.

Critical and essential factors for successful promotion and adoption of the technology	Technology (silicon based fertilizer) availability through local manufacture, blending, distribution and marketing by fertilizer companies and agro dealers Accessibility - Easy access to technology by users that can be facilitated by local agro dealers and support by extension systems. Profitability – sustained yield increase under water stress conditions. Existence of strong farmers' organizations for credit support
Challenges encountered in respecttofurtherdissemination of the technology, adoption and up/out scaling	Lack of enough raw material for local manufacture of Silicon fertilizer due to low/no exploratory inventory
Recommendations for addressing the challenges listed above	Geologic and Agronomic survey to inventory local availability of raw material for Silicon fertilizer manufacture Design efficient on farm and industrial Si fertilizer processing and manufacturing
Lessons learnt on the best ways for addressing the challenges listed above	Creating awareness of the technology through oral means, brochures, demonstration plots, targeting farmers and industry to enable local manufacture and use of Si fertilizer in rain fed agriculture
Gender concern in the development and dissemination of the technology	None
Additional important information about the technology	None
Contact details of the generators and promotors of the technology	Mulungushi University, Email address: kmunsanje@hotmail.com, Telephone: +260 1 211245 Mobile: +260 967 441750 Country: ZAMBIA

5.4 Biochar use for Soil Fertility improvement and Reducing Carbon Emissions in Conservation Agriculture

Title of the technology or innovation	Biochar use for Soil Fertility improvement and Reducing C Emissions in CA

Description of the technology	Biochar is the C-Rich product/ solid remains of thermally decomposed organic matter, from plant or animal sources, under limited oxygen supply at temperatures <700 ^{0}C, It has the ability to sequester carbon and improve soil fertility, Can be used as an energy source and as a strategy for farm waste management. The biochar application in the soil is aimed at exploiting its potential mechanisms for improving soil fertility through enhanced nutrient retention, resulting in decreased leaching losses, thereby increasing the efficiency of soluble fertilizer use in the managed ecosystems and preventing environmental problems such as the generation of soil acidity, eutrophication and ground water pollution. The fringe benefits include the mitigation of climate change through the inherent sequestration of the C. According to a research conducted in Kaoma in Zambia, it was shown that biochar can increase maize yields 4-5 times more than the control in acidic sandy soils. This technology can improve yields in sandy soils as biochar increases the soil CEC and pH. This technology involves charring of agricultural waste such as maize cobs, groundnut shells, rice husks, sorghum stalks etc. The biochar is ground into small grains and applied in the field at the plant station together with the fertilizer. The biochar helps in the retention of the nutrients and water
End users of the technology	The users of the technology are smallholder farmers, millers, researchers
Critical and essential factors for successful promotion and adoption of the technology	Technology (Biochar) availability through the help of the extension officers and researcher, Accessibility - Easy access to technology by users through distribution system and affordable prices of the biochar kiln; Existence and availability of strong farmers' organizations and extension services interactions (public and private).
Challenges encountered in respecttofurtherdissemination of the technology, adoption and up/out scaling	Low capacity of extension officers in sensitization of the technology e.g. on establishing and managing demonstration plots
Recommendations for addressing the challenges listed above	Extension officers as crucial stakeholders in dissemination/ scaling up should demonstrate technologies and sensitize farmers on the benefits of using the biochar
Lessons learnt on the best ways for addressing the challenges listed above	Improve publicity affects adoption

Gender concern in the development and dissemination of the technology	None
Additional important information about the technology	None
Contact details of the generators and promotors of the technology	Mulungushi University, P O Box 80415, Kabwe, Email address: p_simfukwe@yahoo.com, Telephone: Mobile: +260974873336 Country: Zambia

5.5 Use of biochar as a strategy for C sequestration and farm waste management

Title of the technology or innovation	Use of biochar as a strategy for C sequestration and farm waste management
Description of the technology	Biochar is the C-Rich product/ solid remains of thermally decomposed organic matter, from plant or animal sources, under limited oxygen supply (pyrolysis) at temperatures <700 ^{0}C, It has the ability to sequester carbon and improve soil fertility, Can be used as an energy source and as a strategy for farm waste management. Carbon dioxide (CO2) is the primary greenhouse gas emitted through human activities such as the combustion of fossil for energy and transportation, although certain industrial processes and land-use changes. However, emissions and removal of CO2 by natural processes tend to balance, but nowadays the amount of CO_2 in the atmosphere is increasing and causing global warming. The most important characteristic of biochar is its very long half life in comparison with uncharred organic matter. This has two important implications: Biochar additions to soil not only reduce carbon dioxide emissions from energy production but this carbon burial also constitutes a net withdrawal of carbon dioxide from the atmosphere. Such a net sequestration is only achieved in combination with regrowing the biomass that was used to produce the bioenergy in the first place. This net withdrawal makes pyrolysis a carbon- negative bioenergy production technique

End users of the technology	The users of the technology are smallholder farmers, millers, researchers
Critical and essential factors for successful promotion and adoption of the technology	Biochar availability and accessibility through the help of the extension officers and researcher at affordable prices of the biochar kiln; Existence and availability of strong farmers' organizations and extension services interactions (public and private).
Challenges encountered in respect to further dissemination of the technology, adoption and up/out scaling	Low capacity of extension officers in sensitization of the technology e.g. on establishing and managing demonstration plots
Recommendations for addressing the challenges listed above	Extension officers as crucial stakeholders in dissemination/ scaling up should demonstrate technologies and sensitize farmers on the benefits of using the biochar
Lessons learnt on the best ways for addressing the challenges listed above	Collaboration among stakeholders improves adoption
Gender concern in the development and dissemination of the technology	None
Additional important information about the technology	None
Contact details of the generators and promotors of the technology	Mulungushi University, P O Box 80415, Kabwe, Email address: p_simfukwe@yahoo.com Telephone: Mobile: +260974873336, Country: Zambia

5.6 Production of Biochar using double drum kiln

Title of the technology or innovation	Production of Biochar using double drum kiln

Description of the technology	Biochar is the C-Rich product/ solid remains of thermally decomposed organic matter, from plant or animal sources, under limited oxygen supply (pyrolysis) at temperatures <700 ^{0}C, It has the ability to sequester carbon and improve soil fertility, Can be used as an energy source and as a strategy for farm waste management. The equipment: Two metal barrels, 210 l drum and a smaller drum of about 50 cm diameter and 65 cm height). In the larger one you make air intakes some 10 centimeters from the bottom that allow an ample amount of air intake. The smaller vessel, you do nothing with. Fill the smaller vessel with biomass, preferably dry to make the charring procedure more efficient. Use maize cobs or rice husks or groundnut husks in the inner vessel. Put the material in as tight as possible. Put the larger drum upside down on top of the smaller vessel, so the bottom of the drum fits close to the top of the biomass filled vessel. Hold the inner vessel tight to the bottom of the larger when turning it back so the content doesn't spill out. When you have done that, the smaller vessel stands upside down in the larger. No lid, no fastening. Put dry firewood in the space between the two vessels (and some on top). Light it and close the top with a lid which has a hole fitted with a open pipe. After about 3 hrs the biochar is read. And can be emptied on a dry surface. You may have to pour water on it to prevent it from complete combustion. When the biochatr is cool and dry, crush it to small grains of ~<2mm. The biochar is ready for use.

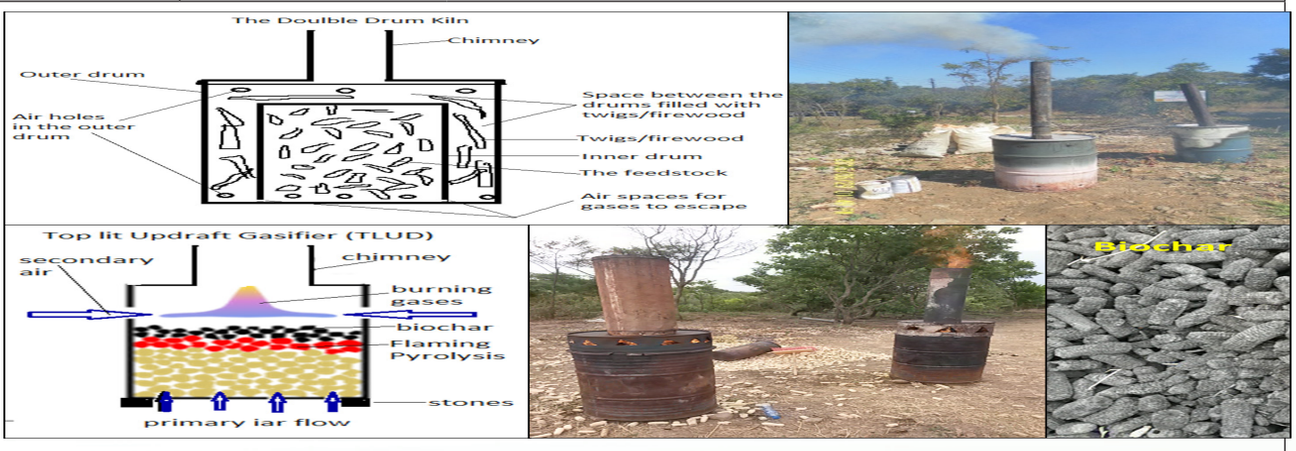

Figure 23: The double drum kiln for making biochar

End users of the technology	he users of the technology are smallholder farmers, millers, researchers
Critical and essential factors for successful promotion and adoption of the technology	Technology (Biochar) availability through the help of the extension officers and researcher Accessibility - Easy access to technology by users through distribution system and affordable prices of the biochar kiln; Existence and availability of strong farmers' organizations and extension services interactions (public and private).

Challenges encountered in respect to further dissemination of the technology, adoption and up/out scaling	Low capacity of extension officers in sensitization of the technology e.g. on establishing and managing demonstration plots
Recommendations for addressing the challenges listed above	Extension officers are crucial stakeholders in dissemination/ scaling up. They should demonstrate technologies to other farmers through Farmer Field Schools, Farmer Field Days and agricultural shows. Farmers should be sensitized on the benefits of using the biochar technology
Lessons learnt on the best ways for addressing the challenges listed above	Enough awareness by farmers of the potential impacts of the technology increases adoption
Gender concern in the development and dissemination of the technology	None
Additional important information about the technology	None
Contact details of the generators and promotors of the technology	Mulungushi University, P O Box 80415, Kabwe Email address: p_simfukwe@yahoo.com Telephone: Mobile: +260974873336 Country: Zambia

5.7 Use of rhizobial inoculum and phosphorus fertilizer in soybean

Title of the technology or innovation	Rhizobium inoculation and P fertilization
Description of the technology	Increased nitrogen fixation by legume plants (Soybean)
End users of the technology	Soybean is grown by both male and female smallholder farmers
Critical and essential factors for successful promotion and adoption of the technology	Low soybean productivity among small scale farmers; awareness of the technologies among farmers is very low. Inoculating soybean with rhizobium and applying P fertilizer increases yields by up to 40%

Challenges encountered in respect to further dissemination of the technology, adoption and up/out scaling	Lack of skills in management of the technology
Recommendations for addressing the challenges listed above	Timely training of farmers and extension agents
Lessons learnt on the best ways for addressing the challenges listed above	There is need to acquire requisite skills for handling of the technology
Gender concern in the development and dissemination of the technology	Legumes are generally considered to be crops for women; they are mostly grown and utilized by women
Additional important information about the technology	Rhizobium and P fertilizers are readily available in the 3 participating countries. The technology just needs to be up scaled.
Contact details of the generators and promotors of the technology	Ndashe Kapulu (PI) Zambia Agriculture Research Institute, Mt. Makulu Research Station, Chilanga, Zambia +260 977 417221 ndacho81@yahoo.co.uk

6.0 LABOUR SAVING CONSERVATION AGRICULTURE TECHNOLOGIES

6.1 Minimum tillage and herbicide utilization in maize production

Title of the technology or innovation	Minimum tillage and herbicide utilization in maize production
Description of the technology	Minimum tillage is a land preparation practice being promoted to help enhance moisture and nutrient conservation with minimal disturbance to the soil and leads to improved productivity in the long term. In this sub-project, ripping and hand-hoe planting basins are the two types of minimum tillage practices being promoted in the livestock-maize and handhoe- /mechanised cultivation systems. Although there are a number of socio-cultural myths and beliefs about the use of herbicides, farmers who are currently using herbicides report labour alleviation/saving, reduced time and costs associated with weed, pest and disease management.
End users of the technology	Smallholder farmers, Research-Extension
Critical and essential factors for successful promotion and adoption of the technology	Strengthen research-extension-farmer linkages, Farmer training on minimum tillage and herbicide utilization (Farmer field schools, workshops), Enhance on-farm demonstrations and awareness creation, Increased access to affordable minimum tillage implements and environmentally friendly herbicides
Challenges encountered in respect to further dissemination of the technology, adoption and up/out scaling	Basin making is labour intensive, Limited farmer knowledge in herbicide utilization Livestock diseases negatively impacting on the adoption of ripping tillage practice
Recommendations for addressing the challenges listed above	Farmer sensitization and training on herbicide utilization, need to strengthen the livestock management programmes at community level, improved monitoring of activities at agricultural camp and district levels, There is need to support the Innovation Platform concept

Lessons learnt on the best ways for addressing the challenges listed above	Need to support and encourage farmer exchange visits and strengthen the Lead Farmer-Follower farmer concept, Regular Extension-Farmer interactions at field level (i.e. during demo implementation, field days, farmer field schools, seed fairs, agricultural shows) Support needs to be given to private sector partners/local artisans who are willing to engage in the production and marketing of minimum tillage implements. This support could mainly be centered around strengthened linkages. Need to intensify technology publicity
Gender concern in the developmentanddissemination of the technology	Most women feel the use of sprayers is a man's job, hence affecting the adoption levels in the herbicide utilization amongst women
Additional important information about the technology	Zambia Environmental Management Agency need to publish herbicides that can be on the Zambian market. There is need to use common names other than scientific names for the different herbicides
Contact details of the generators and promotors of the technology	Zambia Agriculture Research Institute Email address: zaridirector@zari.gov.zm or mwalemp@yahoo.com Telephone: +260 211 27813 Mobile: +260 966 766395 Country: Zambia : Department of Agriculture; Email address: pklungu@yahoo.com Telephone: +260 211 252029Mobile: +260 966 803868 Country: Zambia Department of Agriculture Email address: emchuma@yahoo.co.uk Telephone: +260 211 22331 Mobile: +260 977764097

6.2 Use of herbicides as a labour saving technique: Atrazine 50% SC Excel ATRACEL E

Title of the technology or innovation	Herbicides
Description of the technology	Chemical weeding - is a labour saving technique as opposed to weeding manually. The pre –emergent herbicide (Atrazine 50% SC Excel ATRACEL E) is being used in plots prepared by conversional tillage. The herbicide is sprayed immediately after planting the seed. It is selective and kills other grasses and broad leaved weeds as they germinate leaving sorghum. Plots that are prepared by minimum tillage require both a pre-emergent herbicide and a post emergent herbicide. The post – emergent herbicide (Glyphosate 41% SL AGRICEL GARUD) is nonselective and it kills weeds left standing between the rows in minimum tillage plots.
End users of the technology	The users of technology are small scale farmers as well as commercial farmers
Critical and essential factors for successful promotion and adoption of the technology	Extension services are available through the department of agriculture and ZARI to teach farmers on the use of herbicides. Both the extension worker and the farmer must understand the instruction on mixing of the chemicals and safe handling of the same. The herbicides must be available at trading areas.
Challenges encountered in respect to further dissemination of the technology, adoption and up/out scaling	Absence of agro dealers in remote areas
Recommendations for addressing the challenges listed above	There is need to request traders to include herbicide stocking or agro dealing in their businesses. There is need to publicize to farmers the new outlets for agricultural chemicals that have been put in place by Commodity Holding Company (CHC). CHC has depots in Mazabuka, Kapiri Mposhi (Yara former Green belt) and Mkushi (at Yara).
Lessons learnt on the best ways for addressing the challenges listed above	The number of technologies that a lead farmer explains to other farmers in a demo should be limited to about two.

Gender concern in the developmentanddissemination of the technology	None
Additional important information about the technology	None
Contact details of the generators and promotors of the technology	Agrichem (Z) Limited, Moobola Road, off Kachidza Road, Plot 7321, Industrial area, Lusaka, Zambia, Telephone: +260 211 287359 Country: Zambia ZARI, Mount Makulu Central Research Station P/B 7 Chilanga Email: zaridirector@zari.gov.zm, Telephone: (211) 278380 / 278141 Country: Zambia

6.3 Hand-Held Mechanical Fertilizer Applicator

Title of the technology or innovation	Hand-Held Mechanical Fertilizer Applicator
Description of the technology 	A. The Fertilizer Applicator is a hand held mechanical tool designed to apply granular commercial fertilizer to horticultural and field crops. It has been given an identification name called On Spot Fertilizer Applicator (OSFA) B. The On Spot Fertilizer Applicator is designed to drop accurate, pre-calibrated and recommended amounts of fertilizer to different row crop species. The operating principle is based on the 'walking stick'. Hand pressure on the implement activates a series of spring loads and a ball valve help in controlling the flow rate of fertilizer dropped into/onto the soil from a backpack container carried by the operator. The implement has three main components: the backpack (fertilizer containing/holding compartment), the transfer tube and the fertilizer placement assembly. Figure 24: Hand held mechanical fertilizer applicator

End users of the technology	The users of the technology are smallholder farmers in rural regions of Zambia, Malawi, Mozambique and Angola who cannot afford tractor and animal drawn fertilizer applicators.
Critical and essential factors for successful promotion and adoption of the technology	Labour saving technology. According to farmers that have used the prototype On Spot Fertilizer Applicator indications are that one person can apply 50kg bag of fertilizer in one (1) hour over one lima (2,500m2), while hand application requires four (4) people to apply the same quantity of fertilizer under the same area. Raw materials for fabricating the equipment are locally available. It is affordable and user friendly, It can be used in all areas of the sub-region. It is gender insensitive can be operated by men, women, youth and the elderly. No bending of the back and hence no backache. The Agricultural policy which seeks to promote small scale mechanization in farming operations is very much in favour of this technology.
Challenges encountered in respect to further dissemination of the technology, adoption and up/out scaling	Manufacturing company to do mass production of the On Spot Fertiliser applicator at an affordable cost has not yet been identified (locally or internationally) Lack of project vehicle for this sub project is a hindrance to wider coverage of the target areas, The current cost of producing (research cost) one fertilizer applicator is higher than what small holder farmers can afford
Recommendations for addressing the challenges listed above	Identifying and engaging a reputable manufacturer to do mass production. Extension Officers, Agro Dealers will be trained and then they will disseminate the information to small holder farmers. Economies of scale will play a major role in bringing down the production cost, subsequently the unit price of the applicator
Lessons learnt on the best ways for addressing the challenges listed above	Continuous engagement of project partners and stakeholders is the key to successful dissemination of this technology
Gender concern in the development and dissemination of the technology	None
Additional important information about the technology	None

Contact details of the generators and promotors of the technology	Mr. Joseph Bernard Phakati, Ministry of Agriculture, P.O. Box 40, Chibombo District. Email address: jbphakati@yahoo.com, Telephone: Mobile: +260955807612/+260976246866 Country:Zambia Mr. Musenga Silwawa , Zambia Centre for Horticultural Training, P.O. Box 260525, Kalulushi Email address: msilwawa@gmail.com, Telephone: Mobile:+260974991803/+260967991803,Country:Zambia

6.4 Minimum Tillage

Title of the technology or innovation	Minimum Tillage
Description of the technology	This is a soil conservation system with the goal of minimum soil manipulation necessary for a successful crop production. It promotes soil stability, fertility and porosity. In this demo it is being promoted as an effective way to reduce labour requirement. We are using a hand hoe as a tillage implement. Farmers in their production can also use a hand hoe, an ox drawn ripper or indeed a tractor drawn ripper.
End users of the technology	The users of technology are small scale farmers as well as commercial farmers
Critical and essential factors for successful promotion and adoption of the technology	Minimum tillage can be achieved by using a hand hoe which is widely available, an ox drawn ripper among farmers with cattle and a tractor drawn ripper. The technique is quite profitable, for instance, a single woman can cultivate one hectare in a few days by using a hand hoe and herbicides instead of taking several weeks by cultivating the entire land in the hectare. Apart from labour saving, farmers can reduce on fuel. Extension services are available through the department of agriculture and ZARI.
Challenges encountered in respect to further dissemination of the technology, adoption and up/out scaling	The use of minimum tillage requires the use of herbicides as well and the absence of agro dealers in remote areas poses a challenge

Recommendations for addressing the challenges listed above	There is need to request traders to include herbicide stocking or agro dealing in their businesses. In the meantime, APPSA should give or sale herbicides to interested farmers in demonstration areas.
Lessons learnt on the best ways for addressing the challenges listed above	The number of technologies that a lead farmer explains to other farmers in a demo should be limited to about two.
Gender concern in the developmentanddissemination of the technology	None
Additional important information about the technology	None
Contact details of the generators and promotors of the technology	ZARI, Mount Makulu Central Research Station P/B 7 Chilanga Email: zaridirector@zari.gov.zm Telephone: (211) 278380 / 278141 Country: Zambia

6.5 Minimum tillage and herbicide utilization in maize production

Title of the technology or innovation	Minimum tillage and herbicide utilization in maize production
Description of the technology	Minimum tillage is a land preparation practice being promoted to help enhance moisture and nutrient conservation with minimal disturbance to the soil and leads to improved productivity in the long term. In this sub-project, ripping and hand-hoe planting basins are the two types of minimum tillage practices being promoted in the livestock-maize and handhoe- /mechanised cultivation systems. Although there are a number of socio-cultural myths and beliefs about the use of herbicides, farmers who are currently using herbicides report labour alleviation/saving, reduced time and costs associated with weed, pest and disease management.
End users of the technology	Smallholder farmers, Research-Extension
Critical and essential factors for successful promotion and adoption of the technology	Strengthen research-extension-farmer linkages, Farmer training on minimum tillage and herbicide utilization, Enhance on-farm demonstrations and awareness creation

Challenges encountered in respect to further dissemination of the technology, adoption and up/out scaling	Basin making is labour intensive, Limited farmer knowledge in herbicide utilization, Livestock diseases negatively impacting on the adoption of ripping tillage practice, ck of training for frontline extension staff
Recommendations for addressing the challenges listed above	Farmer sensitization and training on herbicide utilization, need to strengthen the livestock management programmes at community level. There is need to support the Innovation Platform concept at district level
Lessons learnt on the best ways for addressing the challenges listed above	Need to support and encourage farmer exchange visits and strengthen the Lead Farmer-Follower farmer concept, Regular Extension-Farmer interactions at field level, Support needs to be given to private sector partners/local artisans who are willing to engage in the production and marketing of minimum tillage implements.
Gender concern in the development and dissemination of the technology	Most women feel the use of sprayers is a man's job, hence affecting the adoption levels in the herbicide utilization amongst women
Additional important information about the technology	Zambia Environmental Management Agency need to publish herbicides that can be on the Zambian market. There is need to use common names other than scientific names for the different herbicides
Contact details of the generators and promotors of the technology	Zambia Agriculture Research Institute Email address: zaridirector@zari.gov.zm or mwalemp@yahoo.com Telephone: +260 211 27813 Mobile: +260 966 766395 Country: Zambia : Department of Agriculture Email address: pklungu@yahoo.com Telephone: +260 211 252029Mobile: +260 966 803868 Country: Zambia Department of Agriculture Email address: emchuma@yahoo.co.uk Telephone: +260 211 22331 Mobile: +260 977764097

6.6 Conservation Agriculture: Minimum tillage

Title of the technology or innovation	Minimum tillage
Description of the technology	Conservation agriculture is a minimum till technology that involves leaving crop residues on the surface, rotating with legumes and use of herbicides. Plant with first rains and apply pre emergence and post emergence herbicides. Apply basal dressing fertilizers at planting or after seed emergence. Apply top dressing fertilizers two weeks after basal dressing.
End users of the technology	The users of the technology are smallholder farmers in all regions in Malawi and Zambia, all practitioners of the technology including researchers, extension officers, NGOs and policy makers
Critical and essential factors for successful promotion and adoption of the technology	Availability of implements and herbicides, Provision of training on the technology. Accessibility - Easy access to technology by users that can be facilitated by efficient implements distribution system and affordable prices; Profitability - Good market for farm produce. Existence of strong farmers' organizations; Availability of credit support through farmers' groups/cooperatives, Availability of extension services (public and private).
Challenges encountered in respect to further dissemination of the technology, adoption and up/out scaling	Competing uses of crop residues Surface mulching becoming fire hazards Surface mulching becoming a source of pathogen of various diseases such as grey leaf spot. Insufficient supply of CA implements due to lack of suppliers in Malawi and Zambia Low capacity of extension officers to demonstrate the technology.
Recommendations for addressing the challenges listed above	Increase the number of suppliers of implements and herbicides Adequate Extension officers for dissemination/scaling up of the technology should be made available. Appropriate training of extension staff and farmers should be provided Farmers should be sensitized on the benefits of using improved technologies

Lessons learnt on the best ways for addressing the challenges listed above	Creating awareness of the technology through field days, extension circulars, Newsletters and scientific publications. Farmer to farmer extension linkage should be encouraged Regular training of farmers and farmer exchange visits are important in technology dissemination
Gender concern in the developmentanddissemination of the technology	None
Additional important information about the technology	Crop rotation is important in realizing benefits of the technology because it reduces disease and pests infestation when the technology is used. Heavy mulching should be avoided because weed control is done with the use of herbicides
Contact details of the generators and promotors of the technology	Dr. Godfrey Sakala and Dr. A.D.C. Chilimba achilimba@gmail.com /godfrey.sakala@gmail.com 00260961995264/00265991738275 Country: Zambia and Malawi

6.7 Graded CA raised beds with cross ties in Conservation Agriculture

Title of the technology or innovation	Conservation Agriculture based mechanization technologies for the construction of improved raised beds for improve yields, water use efficiency and labour productivity in maize-legume cropping systems
Description of the technology	conventional ridge, furrow system, improved graded ridges prepared using tractors, graded CA raised beds with cross ties
End users of the technology	Farmers (Male, women and youth) and private entrepreneurs, associations and NGOs
Critical and essential factors for successful promotion and adoption of the technology	Women and youth to perceive that these technologies will help in reducing drudgery and will improve their livelihoods. Also the technology will ease the labour burden among women and children at the same time enabling youths to be more attracted to farming by raising awareness to graded raised beds and facilitate access to suitable equipment to build them at local level

Challenges encountered in respect to further dissemination of the technology, adoption and up/out scaling	Low awareness of the technology
Recommendations for addressing the challenges listed above	Increase awareness on the technology
Lessons learnt on the best ways for addressing the challenges listed above	Improved publicity for the technology
Gender concern in the development and dissemination of the technology	Taboos in driving tractors for bed/ridge making. Technologies perceived at being tested by male
Additional important information about the technology	Although it will be practiced by male, it will reduce drudgery for women and increase their time for other activities as well as ease the labour burden among women and children at the same time enabling youths to be more attracted to farming by raising awareness to graded raised beds and facilitate access to suitable equipment to build them at local level
Contact details of the generators and promotors of the technology	Domingos Dias, PI, Av. Trabalho 158, Chimoio, Manica. Cell: +258840622152, e-mail: djosedias@gmail.com Domingos Feniasse, Gondola, EAS. Cell: +258842892539. E-mail: d.feniasse@gmail.com Hilário Cantelo, TLC coordinator. Cell: +258842251246. E-mail: cantelosoplantaslda@gmail.com Nascimento Nhantumbo, Co-PI, ISPM. Cell: +258827411580 e-mail: tonhantumbo@gmail.com Isaiah Nyagumbo, CIMMYT. Cell: +263772238284e-mail: i.nyagumbo@cgiar.org, MacDonald Mwinjilo, Co-PI, Lilongwe University of Agriculture and Natural Resources (LUANAR). E-mail: macmwinjilo@yahoo.com

6.8 Use of Basins /ripping, surface cover with use of herbicides in conservation agriculture

Title of the technology or innovation	Use of Basins /ripping, surface cover with use of herbicides in conservation agriculture
Description of the technology	The basins measure 30 cm long, 15 cm wide and 15 cm deep spacing between basins is 75 cm or 90 cm. Plant four maize seeds per basin and thin to three seeds. Apply fertilizers as recommended and leave crop residues on the surface and use herbicides to control weeds. Ripping is spaced 75 or 90 cm apart and plant four seeds spaced at 75 cm or 90 m apart thinned to three
End users of the technology	The users of the technology are smallholder farmers in all areas who cannot afford tractor driven implements
Critical and essential factors for successful promotion and adoption of the technology	Labour saving technology It is affordable
Challenges encountered in respect to further dissemination of the technology, adoption and up/out scaling	
Recommendations for addressing the challenges listed above	– Extension officers are crucial stakeholders in dissemination/scaling up. They should demonstrate technologies to other farmers through Farmer Field Schools, Farmer Field Days and agricultural shows – More farmers should be sensitized on the use of basins – Farmers to be encouraged to use basins to conserve rain water.
Lessons learnt on the best ways for addressing the challenges listed above	Participatory research involving Research and Extension Scientists with farmers and intensifying interactions with farmers are required
Gender concern in the development and dissemination of the technology	None

Additional important information about the technology	The technology is also aimed in rainwater harvesting that would have sustain production during dry spells and drought
Contact details of the generators and promotors of the technology	Name and contact address of the organisation: Dr. Godfrey Sakala and Dr. A.D.C. Chilimba Email address: achilimba@gmail.com /godfrey.sakala@gmail.com Telephone: Mobile: 00260961995264/00265991738275 Country: Zambia and Malawi

6.9 Use of Herbicides in Conservation Agriculture as a Labour Serving Weeding Technology.

Title of the technology or innovation	Use of Herbicides In Conservation Agriculture as a Labour Serving Weeding Technology
Description of the technology	The technologies being promoted through demonstrations are-: Use of herbicides (pre/post emergence herbicides and selective/non selective herbicides) as a labour serving technology for weed control focusing on choice, timing and application rates, Minimum tillage practices focusing on the use of Chaka hoes and rippers, Permanent organic soil cover with previous season crop residues, Use of cowpeas as a rotational crop under CA, Light hand hoe weeding practice in combination with herbicides.
End users of the technology	Small scale farmers along the maize belts of Malawi, Mozambique and Zambia
Critical and essential factors for successful promotion and adoption of the technology	Closing the gaps with respect to the knowledge, attitudes and practices that undermine herbicide use will enhance the adoption of herbicides among farmers practicing CA

Challenges encountered in respect to further dissemination of the technology, adoption and up/out scaling	Maintenance of crop residues has remained a challenge in crop livestock integration farming systems. Fencing is an alternative, but farmers cannot afford the cost of fencing wire. There was a sudden outbreak of fall worms during the season that triggered an intensive use of chemicals such as Cypermethrin (Pesticide) and compromised crop performance. Livestock encroaching into Demo plots during the season.
Recommendations for addressing the challenges listed above	Incentives for herbicide users such as credit support and enhanced extension services for farmers in order to accelerate adoption of the herbicide technology.
Lessons learnt on the best ways for addressing the challenges listed above	Herbicide use is profitable but budgetary constraints may allude adoption of the technology i.e the most profitable weed management strategy may not be the optimum one for farmers due to budgetary constraints. Farmers are not yet aware that they can opt for cost effective herbicides to achieve the intended purpose.
Gender concern in the development and dissemination of the technology	Both male and female smallholder farmers have an equal opportunity to participate through demonstrations.
Additional important information about the technology	The use of herbicides does not compromise soil fertility and maize productivity. The benefits of herbicides include-: Cost effectiveness, Minimal labour requirements for weeding, Efficient soil and water management.
Contact details of the generators and promotors of the technology	Crispin Pumulo Kapunda (PI Zambia)- Mochipapa Research Station, P.O BOX 630090, Choma (ckapundap@yahoo.com- +260977852279) Amos Ngwira (Malawi) - Department of Agricultural Research Services(DARS)- Malawi Thomas Chichonela (Mozambique)- Faculty of Agronomy and Forestry Engineering-Eduardo Mondlane University in Mozambique

6.10 Early cultivation and crop residue incorporation

Title of the technology or innovation	Early cultivation and crop residue incorporation

Description of the technology	The plots are prepared in April – August each season. The land is cultivated early between April and August when there is enough crop or plant residues. The crop residues are incorporated into the soil and left to decompose. This also prevents the plant / crop residues from being consumed by fire. The decomposition unlocks nitrogen there by improving the nitrogen status of the soil. Soil organic matter is also improved by this technology.
End users of the technology	The users of technology are small scale farmers as well as commercial farmers
Critical and essential factors for successful promotion and adoption of the technology	Technology (Early ploughing and Crop residue incorporation) is available through demonstrations. The cost only comes in form of the capacity to cultivate which can even be achieved with a hand hoe, an oxen or a tractor drawn plough. The technology is quite profitable since it increases the availability of mineral nitrogen for the crop. Extension services are available through the department of agriculture and ZARI.
Challenges encountered in respect to further dissemination of the technology, adoption and up/out scaling	Inadequate resources
Recommendations for addressing the challenges listed above	Timely release of resources for field activities
Lessons learnt on the best ways for addressing the challenges listed above	The number of technologies that a lead farmer explains to other farmers in a demo should be limited to about two.
Gender concern in the development and dissemination of the technology	None
Additional important information about the technology	None
Contact details of the generators and promotors of the technology	ZARI, Mount Makulu Central Research Station P/B 7 Chilanga Email: zaridirector@zari.gov.zm Telephone: (211) 278380 / 278141 Country: Zambia

7.0 LABOUR SAVING PROCESSING TECHNOLOGIES

7.1 Modified Hammer mill

Title of the technology or innovation	Modified Hammer mill
Description of the technology	Metal detection and trapping components are incorporated in traditional hammer mills. This reduces the metal contamination in maize flour and makes it safe for human consumption
End users of the technology	Male and female smallholder farmers
Critical and essential factors for successful promotion and adoption of the technology	Adequate training and awareness
Challenges encountered in respect to further dissemination of the technology, adoption and up/out scaling	Low capacity and training
Recommendations for addressing the challenges listed above	High level of publicity
Lessons learnt on the best ways for addressing the challenges listed above	There is need to increase the promotion of the technology among hammer mill owners
Gender concern in the development and dissemination of the technology	None
Additional important information about the technology	There is need to increase the promotion of the technology among hammer mill owners
Contact details of the generators and promotors of the technology	UNZA; Mwansa Kaoma, Department of Agricultural Engineering. Email: mwansa.kaoma@unza.zm Cell No.: +260 977 583893

7.2 Energy-efficient cookers

Title of the technology or innovation	Energy-efficient cookers
Description of the technology	The energy-efficient cooker uses mostly twigs although charcoal can also be used as fuel. The one destined for introduction has a hexagonal top shape and it is made from a metal exterior and interior internal liner. The internal has holes in its base. The holes allow ash to fall through and be collected in the chamber located at the bottom of the stove. The height ranges from 70–100 mm. The stove has two medium hole on both sides where twigs are inserted and the air enters to support burning of the twigs. It has a pair of pots that are used one at a time. These pots have casings in which these pots are enclosed (with cooked stuff) and can remain hot for as long as they are not frequently opened.
 Figure 25: A female farmer demonstrating how an energy-efficient cooker works. Beans and warm water were done as the team watched	
End users of the technology	Small holder farmers' households

Critical and essential factors for successful promotion and adoption of the technology	• Technology availability through Innovation Fairs of Private Manufacturing Companies. • Accessibility – Once introduced, the SHFs should be able to buy the cookers at affordable prices. • Viability and Profitability – business sustainability and good return for investment • Credit Investment support –particularly by the micro-finance and banks. • Extension services (both public and private) - must support government efforts to promote Value-addition.
Challenges encountered in respect to further dissemination of the technology, adoption and up/out scaling	Ill-timed attention to farmers' plight (training timings usually off target owing to late fund disbursement). Lack of knowledge on environmental pollution by the traditional methods of cooking using fuel-wasting and environmental-polluting cookers Extension officers-also have low understanding of environmental implications of energy-inefficient cookers. Hence, fail to capacitate and sensitize farmers on the natural and environmental aspects of using less efficient methods of cooking.
Recommendations for addressing the challenges listed above	• APPSA to adhere to timelines of each sub-project for fund disbursement • Allow continuous training on entrepreneurship, Business skill development and product marketing strategies-both SHFs and Extension officers (crucial stakeholders) • In addition, environmental pollution aspects must be part of capacitation. • Sensitization on the environmental pollution by traditionally accepted cooking methods
Lessons learnt on the best ways for addressing the challenges listed above	• Creating awareness on the value of preservation of natural and environmental resources • Exploitation of social capital-through Farmer to farmer sharing of information must be encouraged • Regular training of farmers and farmer exchange visits are important in curbing environmental pollution

Gender concern in the developmentanddissemination of the technology	This technology has more focus on women than men
Additional important information about the technology	
Contact details of the generators and promotors of the technology	Technology Development and Advisory Unit, University of Zambia, School of Mechanical Engineering or Department of Agricultural Engineering, University of Zambia, P.O. Box 32379, Lusaka. Tel. +260 211 292763 (contact Dr Isaac Simate) or Mr Victor Pikiti; Mobile: 0977690776 Country: Kabwe, Zambia

7.3 Hammer-mills machines (for Cowpea and Bean leaves)

Title of the technology or innovation	Hammer-mills machines (for Cowpea and Bean leaves)
Description of the technology	A hammer mill is a mill whose work is to crush relatively large and aggregate material into smaller pieces by the repeated and sustained blows of little hammers located in the hammering chamber. These machines have many applications in many industries, including: Ethanol-making plants (using cereal grains). At a farm, hammer mill machines are used to mills grain into coarse or fine flour to be fed to livestock or humans. Sometimes, the by-products is used as an input for other value-addition activities.

Figure 26: Hammer-mills machine for legumes

End users of the technology	Smallholder farmers
Critical and essential factors for successful promotion and adoption of the technology	• Technology availability through Innovation Fairs of Private Manufacturing Companies. • Accessibility and affordability Currently they are at ZK 2500.00 (approx. US$ 250.00). • Viability and Profitability – business sustainability and good return for investment • Existence of vibrant and strong farmer cooperatives in each country. • Credit Investment support –particularly by the micro-finance and banks. • Extension services (both public and private) - must support government efforts to promote Value-addition.
Challenges encountered in respect to further dissemination of the technology, adoption and up/out scaling	• Ill-timed attention to farmers' plight (training timings usually off target owing to late fund disbursement) • Lack of knowledge on Business economics and Marketing, though quick to catch up). • Extension officers-also have low understanding of economic implications of value-addition. Hence, fail to capacitate and sensitize farmers on the value of agro-processing
Recommendations for addressing the challenges listed above	• APPSA to adhere to timelines of each sub-project for fund disbursement • Allow continuous training on entrepreneurship, Business skill development and product marketing strategies-both SHFs and Extension officers (crucial stakeholders). • Legumes Business Vertical integration, capacitation (through dissemination/scaling up of technologies to other farmers through Farmer Field Schools, Farmer Field Days and agricultural shows) is critical • Sensitization on the profitability of legume value-added products (Agro-processing) to Farmers and Extension officers should be a continuous process.

Lessons learnt on the best ways for addressing the challenges listed above	• Creating awareness on the value of processing legumes through method demonstration (to add value to raw produce) and practically using existing market prices to demonstrate the opportunity costs of scarce resources. This has tremendous potential to improve technology uptake. • Exploitation of social capital-through Farmer to farmer sharing of information must be encouraged • Regular training of farmers and farmer exchange visits are important in technology dissemination
Gender concern in the developmentanddissemination of the technology	None
Additional important information about the technology	None
Contact details of the generators and promotors of the technology	Dr Isaac Simate or Mr Victor Pikiti Technology Development and Advisory Unit, University of Zambia, School of Mechanical Engineering or Department of Agricultural Engineering, University of Zambia, P.O. Box 32379, Lusaka. Tel. +260 211 292763 Mobile: 0977690776 Country: Kabwe, Zambia

7.4 De-hullers for all legumes (Cowpeas, Beans, Bambara nuts and Pigeon peas)

Title of the technology or innovation	De-hullers for all legumes (Cowpeas, Beans, Bambara nuts and Pigeon peas)

Description of the technology	This grain processing machinery is capable of processing a wide variety of seeds such as Cowpeas, beans, Bambara nuts, pigeon peas, wheat, mung bean, millet, sorghum, etc. There is screen and grinding wheel in the working cabinet, peeling process goes on in the space between screen and grinding wheel. For maize, the de-huller can de-hulls and de-germ the seed in the production of maize flour. It does the same thing for the grain processing in value-addition industry. It is designed to increase efficiency and de-hulled seed yield through gentle de-hulling and polishing of grain seeds. With two tuyeres, the machine inhale and blow the light peels and fibres at the same time.

Figure 27: De-huller for all legumes

End users of the technology	Smallholder farmers in remote areas and those that cannot afford electricity driven dehullers
Critical and essential factors for successful promotion and adoption of the technology	• It's a labor-saving technology (fast and efficient) • Inputs (raw materials for use-legumes are abundant and locally available). Hence, output and sustainability of inputs is relatively assured. • Can operate in any locality regardless of power availability • Relatively affordable to enterprising SHFs • Current government policy for SHFs stresses the need to add value to farm products rather than selling them in raw form. Hence, the technology has government support.

Challenges encountered in respect to further dissemination of the technology, adoption and up/out scaling	• Most SHFs think value-addition is a preserve of white people. • Lack of entrepreneurial, marketing and business management skills. • Inadequate crop husbandry knowledge, which translate into lower legumes harvest put value-addition activities to their crops, out of reach. • Investment is a costly venture and involve risk. Many SHFs don't like taking risks, a feature which all entrepreneurs must carry if they have to do business. So for them, the prohibitive cost nature of efficient machinery like a de-huller is an hindrance for many resource-poor farmers
Recommendations for addressing the challenges listed above	• Sensitization to both Extension officers and farmers is key. Both have to understand that value-addition activities have no master. Even SHFs can do it very well • Training aimed at capacity building in Entrepreneurship, Business and marketing skills are crucial for all stakeholders in the dissemination of value-addition. Quick learners should share experiences and profitability of value-addition to more conservative counterparts • Farmer Field Days and agricultural shows are conduits for extra knowledge and new information on latest technology achievements • Farmers to be encouraged to keep draft animals to achieve yields worth processing using machinery
Lessons learnt on the best ways for addressing the challenges listed above	• Farmers' Cooperatives are the best organizations to use when first introducing efficient technologies. Later, the same could be used to jointly purchase group machinery which they can use as a group and share proceeds proportional to their committed inputs. • Method Demonstrations and formal workshops are the best conduits and effective in disseminating Entrepreneurship, Business and marketing skills to wider groups of stakeholders (farmers and extension officers)

Gender concern in the developmentanddissemination of the technology	It will ease drudgery on the utilization for household food security
Additional important information about the technology	None
Contact details of the generators and promotors of the technology	Technology Development and Advisory Unit, University of Zambia, School of Mechanical Engineering or Mr Victor Pikiti Mobile: 0977690776 Country: Kabwe, Zambia

7.5 Sun Dryers (for Cowpea and Bean leaves)

Title of the technology or innovation	Sun Dryers (for Cowpea and Bean leaves)
Description of the technology	In the solar dryer: Solar energy passes through the plastic/ glass covering. Once it enters the chamber, the solar is transformed into heat energy. It's this that heat air to a constant temperature. Hence, facilitating extraction of humidity from harvested crops put inside a drying chamber (leaves, grasses etc). Ventilation is facilitated at a constant rate through defined air inlets and outlets. The harvested crops is not exposed to direct sunlight in these solar dryers as the fresh air is heated separately from the drying chamber. This method is preferable for drying foods which lose nutritional value when exposed to direct sunlight.
End users of the technology	The users of the technology will be all interested smallholder farmers initially in Malawi, Mozambique and Zambia and later all farmers in the sub-region

Critical and essential factors for successful promotion and adoption of the technology	• Technology availability through Innovation Fairs of Private Manufacturing Companies. • Accessibility – Once introduced, the SHFs should be able to buy the dryers at affordable prices. Currently they are at K 3000.00 (approx. US$ 300.00). • Viability and Profitability – business sustainability and good return for investment • Existence of vibrant and strong farmer cooperatives in each country. • Credit Investment support –particularly by the micro-finance and banks. • Extension services (both public and private)- must support government efforts to promote Value-addition.
Challenges encountered in respect to further dissemination of the technology, adoption and up/out scaling	• Poor timing of farmers' training timings • Lack of knowledge on Business economics and Marketing, • Extension officers-also have low understanding of economic implications of value-addition.
Recommendations for addressing the challenges listed above	• Timeliness of activities • Continuous training on entrepreneurship, Business skill development and product marketing strategies-both SHFs and Extension officers (crucial stakeholders). • Legumes Business Vertical integration, capacitation (through dissemination/scaling up of technologies to other farmers through Farmer Field Schools, Farmer Field Days and agricultural shows) is critical. Sensitization on the profitability of legume value-added products (Agro-processing) to Farmers and Extension officers should be a continuous process.

Lessons learnt on the best ways for addressing the challenges listed above	• Creating awareness on the value of processing legumes through method demonstration (to add value to raw produce) and practically using existing market prices to demonstrate the opportunity costs of scarce resources. This has tremendous potential to improve technology uptake. • Exploitation of social capital-through Farmer to farmer sharing of information must be encouraged • Regular training of farmers and farmer exchange visits are important in technology dissemination
Gender concern in the development and dissemination of the technology	Gender perception on the effect of the dryers needs to be analyzed
Additional important information about the technology	None
Contact details of the generators and promotors of the technology	Technology Development and Advisory Unit, University of Zambia, School of Mechanical Engineering or Department of Agricultural Engineering, University of Zambia, P.O. Box 32379, Lusaka. Tel. +260 211 292763 (contact Dr Isaac Simate). Zambia

Figure 28: A farmer sharing information on how the solar dryer works-Mulilansolo farm, Kasisi

8.0 CROP STORAGE TECHNOLOGIES

8.1 The Ferrumbu

Title of the technology or innovation	The Ferrumbu
Description of the technology	Walls are made of ½ inch chicken wire reinforcement plastered with cement mortar. Foundation built on stones and concrete floor. Roof and walls are made of concrete and are most durable among solid wall bins as such they prevent entry of insect pests. They are strong enough to resist the horizontal pressure from the stored grain. In addition, they are rodent proof and resist wind forces. The Ferrumbu are easy to clean. The concrete slab floor protects the bin from flooding due to capillary and diffusing moisture.
 Figure 29: Picture of the Ferrumbu	
End users of the technology	Male and female smallholder farmers
Critical and essential factors for successful promotion and adoption of the technology	Adequate trainings and awareness campaigns

Challenges encountered in respect to further dissemination of the technology, adoption and up/out scaling	Low capacity and training
Recommendations for addressing the challenges listed above	There is a need to engage into high level of publicity
Lessons learnt on the best ways for addressing the challenges listed above	Increasing the promotion of the technology among smallholder farmers enables reduction in post-harvest losses.
Gender concern in the development and dissemination of the technology	Most of smallholder farmers are women, hence the postharvest technology is ideal
Additional important information about the technology	
Contact details of the generators and promotors of the technology	ZARI-Mable Mudenda, Plant Protection and Qurantine Division, Mt Makulu Research Station, Private bag 7, Chilanga Cell No: +260972413204, Email:banji.mudenda@gmail.com

8.2 Cement Plastered Basket

Title of the technology or innovation	Cement Plastered Basket
Description of the technology	Walls are made of woven twigs plastered and with cement mortar. The foundation is built of stones and concrete floor or on wooden platform. Twigs prevent entry by insect pests; are rodent proof and resistant to wind forces and vertical pressure from the stored grain. Concrete slab floor protects the bin from flooding due to capillary and diffusing moisture. Roof protects the bin from rain and direct solar radiation.

Figure 30: Picture of the cement plastered basket

End users of the technology	Male and female smallholder farmers
Critical and essential factors for successful promotion and adoption of the technology	Knowledge of the technology and training on maintenance of the technology are critical and essential in the promotion of this technology.
Challenges encountered in respect to further dissemination of the technology, adoption and up/out scaling	Low awareness of the technology
Recommendations for addressing the challenges listed above	Improved publicity on the technology
Lessons learnt on the best ways for addressing the challenges listed above	Improved publicity on the technology
Gender concern in the development and dissemination of the technology	Most of smallholder farmers are women, hence the postharvest technology is ideal
Additional important information about the technology	There is need to increase the promotion of the technology among smallholder farmers
Contact details of the generators and promotors of the technology	ZARI-Mable Mudenda, Plant Protection and Qurantine Division, Mt Makulu Research Station, Private bag 7, Chilanga Cell No: +260972413204, Email:banji.mudenda@gmail.com

8.3 The Metal Silo

Title of the technology or innovation	The Metal Silo
Description of the technology	Walls are made of galvanised sheets and are cylindrical in shape and raised on wooden pallet as foundation. Rubber bands seal the inlet and outlet thus making the silo airtight. In order to create hermetic conditions a candle is lit to deplete remaining oxygen, and this kills any remaining pests. The walls are most durable to allow for long storage periods and prevent entry by insect pests including rodents. The pallet prevents rusting of the base due to moisture and makes cleaning easy. The sheltered place protects the silo from rain and direct solar radiation and provide security from theft.
	 Figure 31: Picture of the metal Silo
End users of the technology	
Critical and essential factors for successful promotion and adoption of the technology	Knowledge of the technology Training on maintenance of the technology
Challenges encountered in respect to further dissemination of the technology, adoption and up/out scaling	Low awareness of the technology

Recommendations for addressing the challenges listed above	Improved publicity on the technology
Lessons learnt on the best ways for addressing the challenges listed above	There is need to increase the promotion of the technology among smallholder farmers
Gender concern in the developmentanddissemination of the technology	Most of smallholder farmers are women, hence the postharvest technology is ideal
Additional important information about the technology	There is need to increase the promotion of the technology among smallholder farmers
Contact details of the generators and promotors of the technology	ZARI-Mable Mudenda, Plant Protection and Qurantine Division, Mt Makulu Research Station, Private bag 7, Chilanga Cell No: +260972413204, Email:banji.mudenda@gmail.com

8.4 Polyethylene Silo Tank (PST)

Title of the technology or innovation	Polyethylene Silo Tank (PST)
Description of the technology  Figure 32: A 100L Polythylene Silo tank	Small Polyethylene Silo tank with volume ranging from 200 to 1000 litres, The PST is light Easy to transport, Easy to install, Made from Polyethylene materials (locally sourced)

End users of the technology	Smallholder farmers, researchers
Critical and essential factors for successful promotion and adoption of the technology	Technology availability through Local agro-dealers and group of farmers, Accessibility - Easy access to technology by users that can be facilitated by well-prepared local dealers and affordable prices; Profitability - Good market for technology product, Existence of strong farmers' organizations; Availability of credit support through farmers' groups, Availability of extension services (public and private).
Challenges encountered in respect to further dissemination of the technology, adoption and up/out scaling	The PST is distributed by Plastex in Maputo, Beira and Nacala cities and is not available in rural communities. In addition, the price is high making it not affordable for many of small-scale farmers.
Recommendations for addressing the challenges listed above	The Promoters should continue the collaboration with Extension Services at local level and nationally. Farmers should be sensitized on the benefits of using improved storage structures in general, and PST in particular, mainly for those farmers who does not possess huge quantities to store. Negotiations with supply companies to find ways to make the technology available in rural areas where studies have proved that farmers are willing to adopt the technology.
Lessons learnt on the best ways for addressing the challenges listed above	• Creating awareness of the technology through oral means (community radios), and demonstration fields, and filed days can improve technology adoption • Lead farmers can play an important role on technology dissemination. The dissemination should be undertaken just after harvest when the demand for grain storage is high. • Farmers and extension agents is postharvest related issues is important to improve the efficiency of technology use
Gender concern in the development and dissemination of the technology	None
Additional important information about the technology	None
Contact details of the generators and promotors of the technology	Eduardo Mondlane University, Faculty of Agronomy and Forestry Engineering. Main Campus, Av. Julius Nyerere 3454, Building 1. Supplier: Plastex Lda; Av Das FPLM 1901, C. Postal no. 90; Email address: lucastivana@yahoo.co.uk, Mobile: +258 824248450, Country: Mozambique

8.5 Super Grain Bag (SGB)

Title of the technology or innovation	Super Grain Bag (SGB)
Description of the technology	The Super grain bags are polyethylene (plastic) bags, which range from 50 kg to 10 000 kg in size. They are cheap to buy and easy to use. The technology can also easily be accessed.

Figure 33: Super grain bag for storage of produce

End users of the technology	
Critical and essential factors for successful promotion and adoption of the technology	Technology availability through Local agro-dealers and group of farmers, Accessibility - Easy access to technology by users that can be facilitated by well-prepared local dealers and affordable prices; Profitability - Good market for technology product (good quality price), Existence of strong farmers' organizations; Availability of credit support through farmers' groups/cooperatives Availability of extension services (public and private)
Challenges encountered in respect to further dissemination of the technology, adoption and up/out scaling	The technology listed above are not available in rural communities. The SGB is only distributed by Agrifocus Lda, in Maputo and Nampula provinces. The SGB in imported and due to high taxes its final price is high making it not affordable for many of small-scale farmers.

Recommendations for addressing the challenges listed above	The Promoters should continue collaboration with Extension Services and local level and nationally. The extension services should demonstrate technologies to other farmers through Farmer Field Schools, Field Days and agricultural shows. Farmers should be sensitized on the benefits of using improved storage structures in general, and SGB, mainly for those farmers who does not possess huge quantities to store.
Lessons learnt on the best ways for addressing the challenges listed above	Creating awareness of the technology through oral means (community radios), demonstration fields, and field days can improve technology adoption, Lead farmers can play an important role on technology dissemination. The dissemination should be undertaken just after harvest when the demand for grain storage is high. Farmers and extension agents are postharvest related issues is important to improve the efficiency of technology use
Gender concern in the development and dissemination of the technology	The Super Grain Bags can be use at different level of production and storage by men and women
Additional important information about the technology	
Contact details of the generators and promotors of the technology	Eduardo Mondlane University, Faculty of Agronomy and Forestry Engineering (Promoter); Main Campus, Av. Julius Nyerere 3453, Main Campus, Building 1, Distributor: Agrifocus Lda; Machava F.P. no. 306/AG/17, Email address: lucastivana@yahoo.co.uk Telephone: Mobile: +258 824248450 Country: Mozambique

8.6 Hermetic post-harvest facilities

Title of the technology or innovation	Hermetic post-harvest facilities
Description of the technology	The metal silo and super grain bag work on the hermitic technology concept (airtight), where the lack of air inside the container suffocates and kills insect pests and reduce the seed damage and weight loss. They have been promoted in other countries, including Malawi, Kenya, Zambia, Zimbabwe and Ethiopia and their reduction of losses in the storage have also been reported. In many African communities, including Mozambique farmers still rely on traditional storage methods without proper / good conditions to take long keeping good quality of the maize. The new storage methods have good condition for keeping maize long time maintain its quality without attack of insects in storage (they promote bad condition for the insects to live and reproduce).

Figure 34: Metal silo for storage of produce using hermitic technology

End users of the technology	Smallholder farmers who grow maize
Critical and essential factors for successful promotion and adoption of the technology	Accessibility - Easy access to technology by users that can be facilitated by efficient sellers (Superbag) and artisans (Metal silos), Profitability - Good market for technology product (good quality price), Existence of strong farmers' organizations; Availability of credit support through farmers' groups/cooperatives, Availability of extension services (public and private).

Challenges encountered in respect to further dissemination of the technology, adoption and up/out scaling	Lack of agro dealers to sell super grain bag in rural areas and lack of Galvanized zin in rural areas for the artisans to fabricate metal silos.
Recommendations for addressing the challenges listed above	Extension officers' crucial stakeholders in dissemination/ scaling up. They should demonstrate technologies to other farmers through Farmer Field Schools, Farmer Field Days and agricultural shows. Farmers should be sensitized on the benefits of using improved technologies.
Lessons learnt on the best ways for addressing the challenges listed above	Creating awareness of the technology through oral means, brochures, demonstration plots etc can improve technology uptake, Farmer to farmer extension should be encouraged, Regular training of farmers and farmer exchange visits are important in technology dissemination
Gender concern in the developmentanddissemination of the technology	None
Additional important information about the technology	
Contact details of the generators and promotors of the technology	IIAM Email address: Telephone: Mobile: Country: Mozambique

8.7 Purdue Improved Cowpea Storage (PICS) bag

Title of the technology or innovation	Purdue Improved Cowpea Storage (PICS) bag
Description of the technology	It is a hermetic bag where use of grain protectants like pesticides is not recommended. The grain is regarded safe because the grain is free from pesticide residues. It will minimize storage losses due to storage pests such as **Prostephanus truncatus** through suffocation
End users of the technology	Male and female farmers and household members
Critical and essential factors for successful promotion and adoption of the technology	It was developed mainly for cowpea storage hence the need to try it on stored maize due to high storage losses in the two countries

Challenges encountered in respect to further dissemination of the technology, adoption and up/out scaling	Availability of the bags and the training required in handling the bags and procedures for using it
Recommendations for addressing the challenges listed above	Timely availability of the bags and requisite training should be provided to end users
Lessons learnt on the best ways for addressing the challenges listed above	Demonstration of the use and increased publicity of the bags
Gender concern in the development and dissemination of the technology	The technology is used on shelled grain and the capacity is 50 kg hence makes it easier for females to load and off-load the grain
Additional important information about the technology	The technology was developed for cowpea storage in west Africa but has not been tried on stored maize
Contact details of the generators and promotors of the technology	Purdue State University in U.S.A. Charles Singano, Chitedze Agricultural Research Station, P.O. Box 158, Lilongwe

8.8 Small metal silo

Title of the technology or innovation	Small metal silo
Description of the technology	It is a hermetic storage facility where use of grain protectants like pesticides is not recommended. The grain is regarded safe because the grain is free from pesticide residues. It will minimize storage losses due to storage pests such as **Prostephanus truncates**. The facility can store grain for more than 3 years without deteriorating in quality. Further to that the facility also prevent rodent and termite attack
End users of the technology	Male and female farmers and household members
Critical and essential factors for successful promotion and adoption of the technology	Availability and affordability of the technology by farmers
Challenges encountered in respect to further dissemination of the technology, adoption and up/out scaling	The cost of installation and training required by farmers on the storage management

Recommendations for addressing the challenges listed above	Demonstrations and training of farmers on the technology
Lessons learnt on the best ways for addressing the challenges listed above	Linkages with dealers and fabricators will enhance the availability and affordability of the technology
Gender concern in the developmentanddissemination of the technology	Easier to offload than traditional granary hence ideal for females
Additional important information about the technology	Originally developed in Latin America but introduced into Malawi
Contact details of the generators and promotors of the technology	Charles Singano, Chitedze Agricultural Research Station, P.O. Box 158, Lilongwe

9.0 INTEGRATED PEST AND DISEASE (IPDM) MANAGEMENT PRACTICES

9.1 Integrated Pest Management

Title of the technology or innovation	Integrated Pest Management
Description of the technology	Cultural / mechanical control, Crop Rotation, Chemical Control of Vectors, Regular Scouting
End users of the technology	The users of the technology are smallholder farmers in MLND susceptible regions, researchers and agriculture extension.
Critical and essential factors for successful promotion and adoption of the technology	Existence of strong farmers' organizations; Availability of extension services (public and private).
Challenges encountered in respect to further dissemination of the technology, adoption and up/out scaling	Inadequate knowledge on IPM Non accessibility to extension services
Recommendations for addressing the challenges listed above	Extension officers' crucial stakeholders in dissemination/ scaling up. They should demonstrate technologies to other farmers through Farmer Field Schools, Farmer Field Days and agricultural shows Farmers should be sensitized on the benefits of using IPM.
Lessons learnt on the best ways for addressing the challenges listed above	Creating awareness of the technology through oral means, brochures, demonstration plots etc can improve technology uptake Farmer to farmer extension should be encouraged Regular training of farmers and farmer exchange visits are important in technology dissemination
Gender concern in the development and dissemination of the technology	None
Additional important information about the technology	None

Contact details of the generators and promotors of the technology	Doctor Gondwe, Department of Agricultural Research Services (DARS) Makoka Research Station, Thondwe, Zomba ,Private Bag 3, Thondwe, Malawi+265 99 732 7675/+265 88 144 3899 doctorgondwe@gmail.com gondwed@aol.com Dr. K.K. Msiska Zambia Agriculture Research Institute (ZARI), Plant Quarantine and Phytosanitary Service, P/B 7 Chilanga, Zambia +260 97 777 1503 msiska12@yahoo.co.uk Banu Belmiro Irénio, Mapupulo Agricultural Research Statio – Montepuez Mozambique Agricultural Research Institute (IIAM) Mozambique+258 86 3874050 banumanhula@gmail.com

9.2 Soil Amendment with Agricultural Lime in Reducing Aflatoxin Contamination in Groundnuts

Title of the technology or innovation	Soil Amendment with Agricultural Lime in Reducing Aflatoxin Contamination in Groundnuts
Description of the technology	Agricultural lime ensures adequate plant nutrition to avoid plant nutrient stress. It reduces aflatoxin contamination, during seed development, which increases susceptibility of groundnuts to fungal infection through pod resistance and seed coat resistance. Agricultural lime tends to reduce A. flavus seed infection and aflatoxin contamination in groundnuts. Soil treatments such as application of lime (0.5t/ha), and manure (10t/ha) and cereal crop residue (5t/ha) at the time of sowing have also been effective in reducing A. flavus seed infection and aflatoxin contamination in groundnuts by 50-90% in studies conducted at ICRISAT research stations in Niger and Mali (Waliyar et al., 2008)
End users of the technology	Small scale farmers who are in groundnut production and build capacity on related aflatoxin control of extension staff
Critical and essential factors for successful promotion and adoption of the technology	Timely distribution of inputs for demonstration, full participation of stakeholders that is the farmers, researchers and extension staff, and favourable climate

Challenges encountered in respect to further dissemination of the technology, adoption and up/out scaling	Late procurement of inputs resulting in late planting, Delayed training of Lead farmers in aflatoxin management and control in groundnut production, Limited number of field days were held to show case the technology, No feedback of results on reduction of aflatoxin contamination in groundnuts by the technology due to technical fault of the HPLC equipment for aflatoxin analysis.
Recommendations for addressing the challenges listed above	Timely field activities
Lessons learnt on the best ways for addressing the challenges listed above	Training of farmers on aflatoxin management and control and hosting of field days in respective target areas.
Gender concern in the development and dissemination of the technology	30-50% shall be female practicing liming technologies with groundnuts
Additional important information about the technology	This technology requires the cooperation of male and female farmers and household members
Contact details of the generators and promotors of the technology	Donald Siyeni, Makoka Research Station, P/Bag 3, Thondwe, Zomba, Malawi banumanhula@gmail.com, Richard Kaunda Misamfu Regional Research Centre P.O. Box 410055, Kasama, Zambia, kaundaric@aim.com/richard.kaunda@gmail.com

10.0 LIST OF ANNEXES

10.1 Summary of technologies generated by APPSA (new) and taken from the shelf (old)

1.0 TECHNOLOGIES FOR MAIZE AND MAIZE-BASED SYSTEMS	Status
1.1 Pro-vitamin A, drought and Low "N" tolerant maize varieties	
1.1.1 Maize variety: MMV409	New
1.1.2 Maize variety: ZM 421	New
1.1.3 Maize variety: ZMS 402	New
1.1.4 Maize variety: GV421	New
1.1.5 Maize variety: GV635	New
1.1.6 Maize variety: GV638	New
1.1.7 Maize variety: GV662A	New
1.2 Pro-Vitamin A maize varieties	
1.2.1 Maize variety: MH45A (APPSA03)	New
1.2.2. Maize variety: MH46A (APPSA06)	New
1.2.3 Maize variety: MH47A (APPSA08)	New
1.2.4 Maize variety: MH48A (APPSA09)	New
1.2.5 Maize variety: MH49A (APPSA13)	New
1.3 Striga tolerant maize varieties	
1.3.1 Maize variety: MH50STR (0501-2STR)	New
1.3.2 Maize variety: MH51STR (1113-1STR)	New
1.3.3 Maize variety: MH52STR (1113-1STR)	New
1.3.4 Maize variety - MZ1 (OPV)	Old
1.3.5 Maize variety - MZ2 (Hybrid)	Old
1.3.6 Maize variety - Sussuma (QPM)	
1.4 Drought tolerant maize varieties	
1.4.1 Maize variety - ZM-523	New
1.4.2 Maize variety - PRIS 601	New
1.4.3 Maize variety – Matuba	Old
1.5 Early and medium maturing maize varieties tolerant to multiple diseases	
1.5.1 Maize variety - Tsangano	Old
1.5.2 Maize variety - MH 26	Old
1.5.3 Maize variety - SC 627	Old
1.5.4 Maize variety - PAN4M-19	New
1.5.5 Maize variety - PHB 2856	New
2.0 TECHNOLOGIES FOR LEGUMES AND LEGUME-BASED SYSTEMS	

2.1 Common bean technologies	
2.1.1 Adaptable common bean varieties which are resistant to bruchids	
2.1.1.1 Chitedze BN1	New
2.1.1.2 Chitedze BN2	New
2.1.1.3 Chitedze BN3	New
2.1.1.4 Chitedze BN4	New
2.1.1.5 Chitedze BN5	New
2.1.1.6 Mnyambitila	Old
2.1.1.7 Namtupa	Old
2.1 2 Bean varieties tolerant to drought, Common bacterial blight, Bean Common Mosaic Virus and Angular leaf spot	
2.1.2.1 G738 (Chitedze Bean 14)	New
2.1.2.2 G1939 (Chitedze Bean 15)	New
2.1.2.3 G11982 (Chitedze Bean 16)	New
2.1.2.4 SAA20 (Chitedze Bean 17)	New
2.1.3 Improved common bean market classes	
2.1.3.1 Black seeded bean variety: ICA PIJAO	New
2.1.3.2 Calima bean Variety: BONUS	Old
2.1.3.3. Sugar bean variety: VTTT 924/2-4-2-1	New
2.1.3.4 Large tan bean variety-Lukupa	Old
2.1.3.5 Grey mottled bean variety- Kabulangeti	Old
2.1.3.6 White bean variety- Kalungu	Old
2.1.3.7 Brownish beans variety – Chambeshi	Old
2.1.3.8 Red speckled bean variety- Lyambai	Old
2.1.3.9 White bean variety- Lwangeni	Old
2.1.3.10.Red mottled bean variety- Mbereshi	Old
2.3 Cowpea technologies	
2.3.1 Short maturing indeterminate Cowpea varieties	
2.3.1.1 Cowpea variety – Msandile	Old
2.3.2 Drought and low nitrogen tolerant cowpea varieties	
2.3.2.1 Cowpea variety - IT00K-126-3	New
2.3.2.2 Cowpea variety - LTII-3-3-12	New
2.3.2.3 Cowpea variety - IT-97K-556-4	New
2.3.2.4 Cowpea variety - LTII-3-3-14	New
2.3.2.5 Cowpea variety - IT-97-1059-6	New
2.3.2.6 Cowpea variety - BB10-3-3-14	New
2.3.2.7 Cowpea variety -IT-90K-277	New
2.3.2.8 Cowpea variety - IT-89K-288	New
2.3.2.9 Cowpea variety – Lutembwe	Old
2.4 Groundnuts technologies	

2.4.1 High yielding and high oil content groundnut varieties	
2.4.1.1 Groundnut variety- MGV4 (CG-7)	New
2.4.1.2 Groundnut variety- MGV5	New
2.4.1.3 Groundnut variety: MGV-6	New
2.4.1.4 Groundnut variety: MGV-7	New
2.4.1.5 Groundnut variety- Chishango	Old
2.4.1.6 Groundnut variety- Katete	Old
2.4.2. High yielding groundnut variety	
2.4.2.1 Groundnuts variety - ICGV-SM 99568	New
2.5 Pigeon pea technologies	
2.5.1 Improved long duration pigeon pea varieties	
2.5.1.1 Pigeon pea - ICEAP 00040	New
2.5.1.2 Pigeon pea - ICEAP 9145	New
2.5.2 Improved medium duration pigeon pea varieties	
2.5.2.1 Pigeon pea variety- ICEAP 00554	New
2.5.2.2 Pigeon pea variety - 00557	New
2.5.2.3 Pea variety: ICEAP 01514/15 (Chitedze PP1)	New
2.5.2.4 Pigeon pea variety: ICEAP 011485/3 (Chitedze PP2)	New
2.6 Soybean technologies	
2.6.1 Medium duration disease resistant soybean Varieties	
2.6.1.1 Soybean Variety: TGX 1908-8F	New
2.6.1.2 Soybean variety: TGX 1740-2F	New
2.6.1.3 Soybean variety – Lukanga	Old
2.6.2 Processed soybean nutritional products	
2.6.2.1 Soymilk	Old
2.6.2.2 Soy Relish	Old
2.6.2.3 Soy bakery products	Old
3.0 TECHNOLOGIES FOR RICE AND RICE-BASED SYSTEMS	
3.1 Aromatic high yielding rice seed delivery systesm	
3.1.1 Rice variety -Supa	Old
3.1.2 Rice variety – Kilombero	Old
3.1.3 Rice variety - Nerica 1	Old
3.1.4 Rice variety- Nene	Old
3.1.5 Rice variety – Mocuba	Old
3.2 Short duration, non-sticky rice variety	
3.2.1 Rice variety – Nerica 4	New
3.3 High yielding rice variety	
3.3.1 Rice variety- Macassane	Old
3.3.2 Rice variety- Mdziva	Old

3.3.3. Rice variety- Limpoto	Old
3.3.4 Rice variety- ITA-312	New
3.3.5 Rice variety- Simao	Old
4.0 TECHNOLOGIES FOR SORGHUM AND SORGHUM-BASED SYSTEMS	
4.1 High yielding and drought tolerant sorghum variety	
4.1.1 Sorghum variety: Kuyuma	Old
4.2 Drought and per-harvest pests tolerant sorghum varieties	
4.2.1 Sorghum variety: ZSV 36 R	New
5.0 SOIL FERTILITY MANAGEMENT TECHNOLOGIES	
5.1 Use of Slurry inoculant in soybeans	New
5.2 Use of D compound and ammonium nitrate fertilizers in sorghum production	Old
5.3 Use of Silicon Based Fertilizer in Maize and Rice Production	New
5.4 Biochar use for Soil Fertility improvement and Reducing Carbon Emissions in Conservation Agriculture	New
5.5 Use of biochar as a strategy for C sequestration and farm waste management	New
5.6 Production of Biochar using double drum kiln	New
5.7 Use of rhizobial inoculum and phosphorus fertilizer in soybean	Old
6.0 LABOUR SAVING CONSERVATION AGRICULTURE TECHNOLOGIES	
6.1 Minimum tillage and herbicide utilization in maize production	Old
6.2 Use of herbicides as a labour saving technique: Atrazine 50% SC Excel ATRA-CEL E	Old
6.3 Hand Held Mechanical Fertilizer Applicator	Old
6.4 Minimum Tillage	Old
6.5 Minimum tillage and herbicide utilization in maize production	Old
6.6 Conservation Agriculture: Minimum tillage	Old
6.7 Graded CA raised beds with cross ties in Conservation Agriculture	Old
6.8 Use of Basins /ripping, surface cover with use of herbicides in conservation agriculture	Old
6.9 Use of Herbicides in Conservation Agriculture as a Labour Serving Weeding Technology.	Old
6.10 Early cultivation and crop residue incorporation	Old
7.0 LABOUR SAVING PROCESSING TECHNOLOGIES	
7.1 Modified Hammer mill	New
7.2 Energy-efficient cookers	Old
7.3 Hammer-mills machines (for Cowpea and Bean leaves)	New
7.4 De-hullers for all legumes (Cowpeas, Beans, Bambara nuts and Pigeon peas)	Old
7.5 Sun Dryers (for Cowpea and Bean leaves)	New
8.0 CROP STORAGE TECHNOLOGIES	
8.1 The Ferrumbu	Old

8.2 Cement Plastered Basket	Old
8.3 The Metal Silo	Old
8.4 Polyethylene Silo Tank (PST)	Old
8.5 Super Grain Bag (SGB)	Old
8.6 Hermetic post-harvest facilities	New
8.7 Purdue Improved Cowpea Storage (PICS) bag	New
8.8 Small metal silo	Old
9.0 CROSS- CUTTING TECHNOLOGIES	
9.1 Integrated Pest Management	Old
9.2 Soil Amendment with Agricultural Lime in Reducing Aflatoxin Contamination in Groundnuts	New

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