

## END OF PROJECT CONFERENCE REPORT FOR AGRICULTURAL PRODUCTIVITY PROGRAMME FOR SOUTHERN AFRICA (APPSA)

**Theme: Regional Collaboration provides a platform for faster  
development and dissemination of technologies under APPSA**



**Holiday Inn Airport Hotel, Johannesburg,  
SOUTH AFRICA  
27 November – 29 November 2019**



**THE WORLD BANK**  
IBRD · IDA | THE WORLD BANK GROUP



## END OF PROJECT CONFERENCE REPORT FOR AGRICULTURAL PRODUCTIVITY PROGRAMME FOR SOUTHERN AFRICA (APPSA)

**Theme:** Regional Collaboration provides a platform for faster development and dissemination of technologies under APPSA



**Holiday Inn Airport Hotel, Johannesburg, SOUTH AFRICA**

**27 November – 29 November 2019**

### CCARDESA Secretariat contacts

Private Bag 00357, Gaborone, Botswana

Tel: +267 391 4997

### For more information

Website: [www.ccardesa.org](http://www.ccardesa.org)

Facebook: <http://www.facebook.com/ccardesa>

Twitter: <http://www.twitter.com/ccardesa>

D-groups: <https://dgroups.org/groups/fara-rails/>



**THE WORLD BANK**  
IBRD · IDA | THE WORLD BANK GROUP

## TABLE OF CONTENTS

List of acronyms .....	5
<b>1 Introduction .....</b>	<b>7</b>
1.1 Background.....	7
1.2 Opening Remarks.....	8
1.2.1 By Heads of Research and World Bank Representative.....	8
1.2.2 By CCARDESA Board Member.....	8
<b>2 Session One: Regional Centre of Leaderships (RCoLs), Research and Development .....</b>	<b>12</b>
2.1 Keynote Presentation- APPSA Overview: Monica Murata- APPSA Coordinator .....	12
2.2 Maize Research and Development.....	12
2.2.1 Major Results for Maize R& D.....	13
2.2.2 Lessons Learned from the maize R&D.....	13
2.3 Legumes Research and Development.....	13
2.3.1 Major Results of Legumes R&D .....	14
2.3.2 Lessons Learned from Legumes R&D.....	14
2.4 Rice Research and Development .....	14
2.4.1 Major Results of Rice R&D .....	15
2.4.2 Lessons learned from Rice R&D.....	15
2.5 Cassava Research and Development.....	16
2.5.1 Major Results for Cassava R&D.....	16
2.5.2 Lessons Learned from Cassava R&D.....	17
<b>3 Session Two: Monitoring, Evaluation, Learning and Communication .....</b>	<b>18</b>
3.1 Keynote 1: The role of monitoring, evaluation and learning of R& D Projects .....	18
3.2 Keynote 2: Knowledge management and communication in R & D Projects.....	18
3.2.1 Major Results for M&E, Learning and Communication.....	19
3.2.2 Lessons Learned from M&E, Learning and Communication.....	19
<b>4 Session Three: Crop Improvement.....</b>	<b>20</b>
4.1 Keynote: Crop Improvement .....	20
4.2 Major Results for Crop Improvement .....	21
4.2.1 Improving Nutrition quality in maize in Malawi, Mozambique and Zambia.....	21

4.2.2	Establishment of core collection of reference varieties and drought tolerant thresh old for maize in Malawi, Mozambique and Zambia .....	22
4.2.3	Development of maize varieties tolerant to drought and heat by use of double haploid technology as a mitigation to climate change in Malawi, Mozambique and Zambia .....	22
4.2.4	Development of high Iron and Zinc beans with resistant to Angular leaf spot and Common bacterial blight in Zambia, Malawi and Mozambique .....	23
4.2.5	Use of Root and Shoot Traits in Screening Common Bean Genotypes Tolerant to Drought in Malawi, Mozambique and Zambia .....	24
4.2.6	Development and Promotion of Improved Pigeon Pea Varieties for increased and Sustainable production (Lutangu Makweti) .....	24
4.3	Adoption of released pigeon pea (cajanus cajan (L.) Milli sp.) Varieties in Mozambique Malawi and Zambia .....	25
4.4	Breeding Groundnut Varieties for Multiple Disease Resistance for Market access in Malawi, Mozambique and Zambia (Lutangu Makweti) .....	25
4.5	Development of Improved Rice varieties in Mozambique & Zambia .....	26
4.6	Performance of MUCUBA, CXT30 AND IR50404 under rainfed lowland ecologies .....	26
4.7	Lessons Learned from Crop Improvement .....	27
<b>5</b>	<b>Session Four: Integrated pest and disease management.....</b>	<b>29</b>
5.1	Keynote: Integrated Pest Management (IPM)- relevance to GAPs for Sustainable Crop Production .....	29
5.2	Major Results for IPM.....	29
5.2.1	Pathogens limiting cassava culture in Angola, Zambia and Mozambique .....	29
5.2.2	Breeding for Maize Leaf Necrosis Disease tolerance.....	30
5.2.3	Efficacy of Chem TICA Pheromone Trap Against Fall Armyworm (FAW) Spodoptera Frugiperda (J.E. SMITH) (LEPIDOPTERA: NOCTUIDAE) .....	31
5.3	Lessons Learned from IPM.....	31
<b>6</b>	<b>Session Five: Mechanisation, post-harvest and value chain .....</b>	<b>33</b>
6.1	Keynote: Post-harvest processing and value addition .....	33
6.2	Major Results for Mechanisation, Post-Harvest Processing and Value Addition.....	34

6.2.1	Improving rice processing and nutrition through supplementation of rice sub products to rural women and orphan children in Mozambique, Malawi and Zambia .....	34
6.2.2	Improved Grain Storage Structures for smallholder farmers in Mozambique and Zambia .....	35
6.3	Lessons Learned from Mechanisation, Post-Harvest Processing and Value Addition .....	35
<b>7</b>	<b>Session Six: Climate Smart agriculture- Conservation Agriculture .....</b>	<b>36</b>
7.1	Keynote: Climate smart Agriculture .....	36
7.2	Major Results from Climate Smart Agriculture .....	36
7.2.1	Disease and Pest Challenges in Maize Production under Conservation Agriculture Cropping Systems; What do we learn? .....	36
7.3	Lessons Learned from CSA.....	37
<b>8</b>	<b>Session 7: Social Economic Studies.....</b>	<b>38</b>
8.1	Major Results for Socio-Economic Studies .....	38
8.1.1	Determining the availability and accessibility of APPSA-promoted technologies by smallholder farmers: An Agro-dealer Perspective Analysis in Zambia.....	38
8.1.2	Determinants of adoption of improved varieties of maize, rice and beans in Malawi, Mozambique and Zambia.....	38
8.1.3	Profitability of Maize, Rice and Common bean in Mozambique, Malawi and Zambia .....	38
8.2	Lessons Learnt from Socio-Economic Studies.....	41
<b>9</b>	<b>Session Eight: Technology dissemination and seed system.....</b>	<b>42</b>
9.1	Keynote: Technology Dissemination and Dissemination Pathways .....	42
9.2	Major Results for Technology Dissemination .....	43
9.2.1	Enhanced dissemination of improved technologies for increased production..	43
9.2.2	Field performance evaluation and dissemination of small tractors in Conservation Agriculture in Central Mozambique and Malawi (CA-P06-2016) .....	43
9.2.3	Strengthening Legume seed delivery systems in Mozambique- The role of promotional campaigns on technology dissemination and adoption.....	44
9.2.4	Dissemination Pathways .....	44
9.3	Lessons Learned from Technology Dissemination .....	45
<b>10</b>	<b>Summary of Major Project Challenges .....</b>	<b>46</b>

10.1	Summary of Major Recommendations .....	46
<b>11</b>	<b>Way Forward- Country Specific.....</b>	<b>48</b>
11.1	Lesotho.....	48
11.2	Zimbabwe.....	48
11.3	Malawi.....	48
11.4	Mozambique .....	49
11.5	Zambia .....	49
<b>12</b>	<b>Board chairs' closing remarks .....</b>	<b>51</b>
<b>13</b>	<b>Key Takeaways.....</b>	<b>52</b>
<b>14</b>	<b>Annexes .....</b>	<b>53</b>
14.1	The CCARDESA Tag line development and Launch of Mobile Learning App .....	53
14.2	Display of key outputs from the APPSA RCoLs .....	55
14.3	Concluding submissions from the APPSA 1 Countries- Malawi .....	57
14.4	Concluding remarks from the APPSA 1 Countries: Mozambique .....	57
14.5	Concluding Remarks from the APPSA 1 Countries: Zambia .....	58
14.6	Program of events for the End of Project Conference .....	61

## List of acronyms

AEZ	Agro-ecological Zone
APPSA	Agricultural productivity programme for Southern Africa
CA	Conservation Agriculture
CBSD	Cassava Brown Streak Disease
CCARDESA	Centre for Coordination of Agricultural Research and development for Southern Africa
CGIARs	Consultative Group for International Agricultural Research
CIAT	International Centre for Tropical Agriculture
CIMMYT	International Centre for Maize and Wheat Improvement
CMD	Cassava Mosaic Disease
COMESA	Common Market for East and Southern Africa
DT	Drought Tolerance
ECQ	Eating and Cooking Quality
ELS	Early Leaf Spot
FAW	Fall Armyworm
FISP	Farmer Input Support Programme
FSP	Farmer Support Programme
GAPs	Good Agriculture Practices
GRD	Groundnut Rosette Disease
IPPC	International Plant Protection Convention
IPDM	Integrated Pest and Disease Management
IPM	Integrated Pest Management
IPPM	Integrated Pest and Production Management
LGB	Larger Grain Borer
MEL	Monitoring, Evaluation and Learning
MLND	Maize Lethal Necrosis Disease
MoH	Ministry of Health
MS	Metal Silo
NARS	National Agricultural Research Systems
NGO	Non-Governmental Organization
NPPO	National Plant Protection Organisation
PDO	Project Development Objective
PHL	Post-Harvest Losses

PHM	Post-Harvest Management
PPP	Public Private Partnerships
PST	Polythene Silo Tanks
QPM	Quality Protein Maize
RCoLs	Regional Centre of Leaderships
R&D	Research and Development
SADC	Southern African Development Community
SGB	Super Grain Bag
SR	Systematic Review
VAD	Vitamin A Deficiency



# 1 Introduction

## 1.1 Background

The Centre of Coordination of Agricultural Research and Development for Southern Africa (CCARDESA) is a subsidiary organization of the Southern African Development Community (SADC). It was established in 2011 and started its full operation in 2013. CCARDESA has a mandate of coordinating agricultural research and development in the SADC region and contributing to better food security and livelihoods in the region. Among the Research and Development (R&D) programmes being coordinated by CCARDESA is the Agricultural Productivity Programme for Southern Africa (APPSA).

APPSA is a regional project supported by separate World Bank-IDA credits to three countries in the region, namely Malawi, Mozambique and Zambia, and a World Bank-IDA grant for CCARDESA. The project began activities in the three countries in October/November 2013 and was expected to close in January 2020. APPSA sought to promote regional collaboration and to put in place mechanisms to encourage technology generation and dissemination across borders of participating countries in the SADC region by (i) supporting regional collaboration in agricultural research, technology dissemination and training; (ii) establishing regional centres of leadership (RCoLs) on commodities of regional importance, and (iii) facilitating increased sharing of agricultural information, knowledge and technology among participating countries. APPSA was designed to support an initial set of countries to participate, and coverage will expand over time to include more countries. Under APPSA, CCARDESA played a key role in facilitating collaborating between countries and acting as broker for the exchange of information.

Given that the project was coming to an end on 31<sup>st</sup> January 2020 and that most of the R&D projects had been completed and research outputs were generated, an end of project conference was held in order to facilitate the sharing of research outputs with a broader group of APPSA stakeholders. This was conducted from 27 to 29 November, at Holiday Inn Airport Lodge in Johannesburg. The purpose of the conference was to provide a forum for research and development practitioners to present and discuss outputs from the APPSA research, most recent trends, innovation, best practices in agricultural research for development and lessons learnt. This report documents the major outputs, lessons and way forward based on presentations, Keynote addresses and discussions during the conference.

## 1.2 Opening Remarks

### 1.2.1 By Heads of Research and World Bank Representative

Each of the Heads of Research from the three APPSA 1 participating countries (Malawi, Mozambique and Zambia) or their representative gave opening remarks. They each emphasized the need for participants to openly discuss their experience with regards to APPSA implementation during its six (years) life and draw lessons for a possible APPSA Phase II. The World Bank Representative also made his remarks and acknowledged the achievements made in APPSA 1 and looked forward to the deliberations of the Conference.

### 1.2.2 By CCARDESA Board Member

Madam M.E. Mogajane, one of the Board members of APPSA made opening remarks and had this to say: “It is my privilege and honour to deliver opening remarks at this end-of-Project Conference for the Agricultural Productivity Programme for Southern Africa (APPSA) coordinated by CCARDESA. At the very outset, may I extend a warm welcome to all the participants from different countries of the SADC region and beyond, who have gathered here on this occasion. Welcome to South Africa and to Johannesburg, the city of gold. This humble gathering of research and development practitioners and stakeholders working for the cause of agriculture and food security provides a unique opportunity for the delegates to learn about efforts by the Agricultural Productivity Programme for Southern Africa (APPSA) to boost agricultural productivity in the region.

APPSA is a six-year project that was approved by the World Bank Board on March 14, 2013 with US\$ 90 million in IDA financing for Malawi, Mozambique and Zambia. It will close on 31 January 2020.

The overall objective of the project is to improve technology generation and dissemination within and among participating countries in Southern Africa by building capacity within national R&D systems and enhancing regional collaboration. APPSA is pursuing this objective by: (i) establishing Regional Centers of Leadership (RCoL) on commodities of regional importance, thereby allowing regional specialization around priority farming systems and more strategic investment in agricultural research capacity; (ii) supporting regional collaboration in agricultural research, technology dissemination, and training; and (iii) facilitating increased sharing of agricultural information, knowledge and technologies.

As we are all aware, the Agricultural sector remains the main source of growth and employment in most countries in the SADC region. Most people living in rural areas rely on agricultural production for their survival. Their biggest challenge however is low productivity, which they have lived with for a very long time. This, therefore, makes APPSA one of the most relevant programs to help the region to address a key challenge to food and nutrition security.

APPSA implementation commenced in late 2013 and has focused on:

- strengthening regional collaboration,
- generating technologies based on identified research and development priorities,
- disseminating proven technologies,
- strengthening the Regional Centres of Leadership (RCoL) in the 3 participating countries; and
- training stakeholders to increase technology uptake and utilization.

In all this work, the project endeavoured to utilise different strategies and approaches to the development of outputs and outcomes so as to ensure a sustained impact after the closure of the project.

Beside technology generation and dissemination, the three countries have established Regional Centres of Leadership for maize in Malawi, rice in Mozambique and legumes in Zambia. These three countries have strengthened their core capacity through infrastructure and human capacity development.

Over the past six years of implementation, APPSA has registered a number of key achievements in Malawi, Mozambique and Zambia. I note that the project has reached 4.61 million beneficiaries in the region with the various improved technologies and management practices.

More than 100 technologies have been developed, while 68 were shared across countries. Significant infrastructure and human resource development have been accomplished within the last 6 years. This is a huge achievement whose impacts will be seen for many years to come. This achievement would not have been possible without the valuable financial support provided by the World Bank, for which we are very grateful.

On behalf of the Board of Directors of CCARDESA, I wish to commend Malawi, Mozambique and Zambia for this unprecedented level of success on regional agricultural projects.

Unfortunately, the project is closing on 31 January 2020. However, we are proud of the outputs of this project which has set a high standard for the new countries to beat. It has also set a good example of how resources from cooperating partners should be utilized.

The success of the project in Malawi, Mozambique and Zambia has been a good incentive for the two new countries, Lesotho and Angola, who have joined APPSA and are positioned for total success in the next 6 years. The success of this project should also encourage other SADC countries to join this project so that it covers the entire SADC region.

I would like to thank CCARDESA and the 3 countries for organizing this Conference, whose purpose is to provide a forum for research and development practitioners to learn about and discuss outputs from the APPSA project.

Coming together as you have done, to reflect and exchange experiences is an essential process of placing science and innovation at the centre of finding solutions to regional challenges. It is therefore important to listen to the positive outputs of the project and pick lessons that can shape our future research for development endeavours.

Nelson Mandela said, “Education is the most powerful weapon which you can use to change the world.” For the next 3 days, I look forward to very lively discussions that aim at uplifting the sustained productivity of small-scale farmers in the region.

Chairperson, distinguished ladies and gentlemen, with these remarks, it is now my distinct pleasure to declare the APPSA Conference officially open.

I thank you all”.



***The officials who gave remarks at the opening session and on the far left is the Board Chair who gave the official opening speech at the Conference.***

# Conference Proceedings Summary

The Conference report has been prepared to capture all the presentations and discussions made at the three-day End of Project Conference. The major component of the report from Section 2 to 9 captures the major results of the APPSA R&D interventions in the three RCoLs. The outline of the report for each section captures the following subjects:

- Title of the thematic area
- The Keynote presentation for the theme
- Major Results
- Key outputs
- Lessons Learnt from that theme

Sections 10 to 13 have provided the summary, conclusions as well as recommendations arising from the presentations and discussions at the conference. Section 12 provides the closing remarks by the CCARDESA Board Chair.

Section 4 of the report provides Annexes for other Conference agenda items that include the development of the Tag line for CCARDESA as well as the launch of Mobile Learning App and the detailed concluding remarks from the three APPSA 1 countries.

## 2 Session One: Regional Centre of Leaderships (RCoLs), Research and Development

### 2.1 Keynote Presentation- APPSA Overview: Monica Murata- APPSA Coordinator

The presentation made reference to the fact that the project funded by the World Bank, Agricultural Productivity Program for Southern Africa (APPSA) was intended to increase the availability of improved agricultural technologies in participating countries in the Southern African Development Community (SADC) region. The project's first component was technology generation and dissemination. This component financed technology generation and dissemination activities associated with the commodity or commodity group being targeted by Regional Centre of Leaderships (RCoLs). The second component of the project was strengthening regional centres of leadership. The third component of the project was coordination and facilitation. This component financed three main categories of activities: (i) national level research coordination and management, (ii) regional facilitation by Centre for Coordination of Agricultural Research and Development for Southern Africa (CCARDESA), and (iii) Research and Development (R&D) policy analysis and dialogue.

As a regional project coordination, the Centre for Coordination of Agricultural Research and Development for Southern Africa (CCARDESA), which was founded by SADC member states to harmonise the implementation of agricultural research and development (R&D) in the SADC region adopted APPSA as one of its programmes. CCARDESA intends to address agricultural research and design issues in the SADC region through the following interventions:

- Coordinating implementation of regional agricultural R&D programmes
- Facilitating collaboration among stakeholders of the National Agricultural Research Systems (NARS)
- Promoting Public – Private Partnerships (PPP) in regional agricultural R&D
- Improving agricultural technology generation, dissemination and adoption in the region through collective efforts, training and capacity building

### 2.2 Maize Research and Development

(Kesbell Kaonga)

---

The presentation gave an overview of the highlights of the maize research and development activities. Led by Principal Investigator (PI) from Malawi as the Regional Centre of Leadership (RCoL) for maize. The thematic areas included breeding, agronomic practices, post-harvest and food safety, plant protection and dissemination of maize technologies. By far the largest number of sub-projects for the maize R&D were the 7 for the maize breeding activities. The major traits of focus in the maize breeding sub-projects were resistance/tolerance to pests, tolerance to drought and heat and improvement of nutritional quality. The other thematic areas were supportive of the breeding efforts as they provided the environment for testing of the performance of the maize varieties developed by the programme. The agronomic aspects of the maize R&D have largely focused on promotion of Conservation Agriculture in the maize production system

### 2.2.1 Major Results for Maize R& D

The maize R&D has made substantial achievement in the generation and dissemination of technologies. The cumulative regional total of maize technologies made available to farmers was 152 against a targeted figure of 244. Several maize varieties with improved traits of consideration have been developed and released in the three countries. The number of maize varieties made available to farmers in Malawi were 36 while 8 Agronomic practices, 1 post-harvest and 3 labour saving technologies have also been disseminated to farmers. Details of the results of the specific traits are provided under the relevant thematic areas in this report. It is important to note that some technologies were responsive to climate change and that others required enhancement of multidisciplinary approach. The project has also started to address important emerging issues in the sub-region. The APPSA programme was among the first to develop sub-projects for research on management of FAW, while there were sub-projects to address climate change and maize leaf necrosis virus (MLNV).

### 2.2.2 Lessons Learned from the maize R&D

The achievements made so far from APPSA indicate that science has the potential to solve crop production problems, food safety, human nutrition, food security etc. It has also become imperative that Climate Change needs more attention. It was also observed that in order to contribute to significant improvement in productivity of the maize production systems, agronomic packaging is important. Emerging issues are important and need more attention.

## 2.3 Legumes Research and Development

(Kennedy K. Muimui, Laurent Pungulani and Manuel Amane- Lead scientists)

---

The presentation highlighted the many global challenges facing humanity. These include; (i) achieving food security for a rapidly growing population; (ii) slowing the progression of climate change by reducing the production and release of greenhouse gases as consequence of human activity and; (iii) meeting the increasing demand for clean energy that will not harm the environment.

Legumes have a significant role to play in contributing to addressing these challenges as they provide a diverse range of food crops that are significant sources of plant-based proteins for humans globally. Grain legumes present outstanding nutritional and nutraceutical properties, while being an affordable food that contributes to achieving future global food and food security in the context of an increasing world population.

Legumes also provide other crucial services to agriculture through their ability to fix atmospheric nitrogen by rhizobial symbiosis, hence supplying accessible nitrogen to agro-ecosystems, increasing soil carbon content, stimulating the productivity of subsequent crops by increasing the effective capture, productive use and recycling of water and nutrients, and helping to control weeds.

In this regard, the project objectives for the legumes R&D included:

- To generate Legume based technologies for increased productivity and production for both small scale and commercial farmers in Malawi, Mozambique and Zambia
- To develop appropriate production packages for the farming community and stakeholders
- To enhance utilization of legumes at household level

### 2.3.1 Major Results of Legumes R&D

The legumes R&D has resulted in the generation and dissemination of more than 90 technologies to smallholder farmers. The technologies include the following:

- 67 varieties (31 released and 36 pre-released) of mostly beans and groundnuts and a few of cowpea and pigeon peas.
- Production packages addressing row planting for beans and cowpeas, use of lime in groundnuts to address Aflatoxin contamination, double row ridge for planting groundnuts and use of inoculum in soybeans
- Utilization packages for management of Aflatoxin in groundnuts, and formulated cowpea-based weaning food.

### 2.3.2 Lessons Learned from Legumes R&D

Emerging lessons point to the strong involvement of agricultural extension agencies as partners as being critical in the implementation of the R&D activities, particularly because of the role they play in providing feedback to researchers. Hands-on training of farmers increased their interest and knowledge. It was discovered that farmers' trainings were more productive when one topic was handled at a time.

The partnerships/networking with CGIAR centres facilitated germplasm acquisition and improved the scientific quality of research. Some scientists had good working experience and were complementary in developing technologies within a short space of time. Furthermore, the collaboration among countries and working in multi-disciplinary teams was important in achieving the goals and objectives of the programme. The enhanced learning and diversity in the execution of sub projects which led to better results was equally identified as a good lesson to carry forward.

## 2.4 Rice Research and Development

(Pualino Munisse)

---

The presentation emphasized that the need to increase the production and productivity of rice to meet the gap can never be overemphasized. Therefore, APPSA was investing resources on technology generation and dissemination on rice. The efforts of the rice R&D were meant to reduce import cost and contribute to food and nutritional security.

The key research areas for rice included; (i) Germplasm collection, characterization and conservation; (ii) Development of improved rice varieties; (iii) Enhancing productivity of rice varieties through: Development of integrated crop and water management practices and the Introduction of rice – duck-based farming system, (iv) Promotion and dissemination of improved rice technologies for sustainable production, (v) Strengthening rice seed delivery system, (vi) Improving rice processing and nutrition through supplementation of rice sub products.

The objectives of this research include: (i) To prevent the loss of indigenous rice germplasm and increase availability of readily accessible and properly characterised germplasm for rice improvement, (ii) Develop suitable rice varieties that are tolerant and resistant to abiotic and biotic factors with preferred traits for all value chain actors and make available for main rice growing ecosystems, (iii) To increase rice productivity through better crop and post-harvest management practices, (iv) To increase availability of quality seeds; (v) Contribute to improved food, income and nutrition security through increased rice production using the innovative technologies and dissemination methodologies, (vi) To improve nutrition of rural women and orphaned children through the introduction of rice sub products processing technologies.



### 2.4.1 Major Results of Rice R&D

The achievement of the rice R&D regarding technology generation and dissemination after the 6 years of the APPSA programme was 35 out of a target of 98 technologies. Nine varieties have so far been presented for release in the three countries, while 24 promising lines have been identified. As for agronomic practices, a total of 14 technologies have been generated while 2 technologies have been generated for post-harvest and processing. Regarding disseminated technologies, 15 varieties and 10 agronomic practices have been made available to smallholder farmers.

### 2.4.2 Lessons learned from Rice R&D

Adoption of technologies and innovations requires a degree of behavioral change by all actors along the scaling up pathway.

The key principles for effective successful accelerated adoption of agricultural technologies that is characterized by improved ownership, commitment, as well as acceptability include:

- The use of technology should be as simple as possible;
- The outcomes should be visible and greater than the traditional ones, in its scaling up activities.
- Relevance of the participatory research methods involving key value chain actors.

Appropriate collaboration between public and private partners is needed for timely allocation of resources.

High value-added products can generate new earning opportunities for youth and rural women and hence supporting market linkages and corresponding capacity building is crucial in this regard. The involvement of young, motivated and committed farmers is key for success and sustainability of the project.

The involvement of CGIARs and other international partners is key to facilitate the availability of resource and improve the scientific quality of the research.

There should be flexibility in implementation to accommodate lessons as they emerge.

## 2.5 Cassava Research and Development

(Jamisse Amisse)

---

The focus of the presentation was on R&D activities that have largely been implemented in Mozambique as not many sub-projects have been implemented for cassava so far. The presenter made reference to the fact that despite its importance, cassava production in Mozambique is limited by several pests/diseases. The presenter stated that an epidemiology study, aimed at determining disease occurrence, associated pathogens, the extent and severity and identify higher risk cultivation areas, served as an important strategy towards the control of two major cassava diseases (Cassava Brown Streak Disease (CBSD) and the Cassava Mosaic Disease (CMD)).

Cassava is tolerant to water stress, however the yield could be affected when the plant is under stress for more than 3 months, for instance climatic events, such as extended drought has been observed to lead to lower yield in Southern Mozambique. Identification of drought tolerant cassava genotypes, suitable for utilization by farmers living in drought zones, was therefore necessary. In order to improve the processing of cassava for different uses, it was important to map out the various physical and chemical properties of existing and most used cassava cultivars as well as the new released cassava varieties and test them for selected types of final utilization.

### 2.5.1 Major Results for Cassava R&D

Some of the results so far obtained from the three sub-projects highlighted above include the following:

- Three cassava varieties selected by the farmers based on the disease resistance/tolerance, yield and adaptability. Under farmer's field multiplication in 5 districts in Mozambique.
- Identified two varieties (for utilization and processing for industries) in Mozambique
- One modified protocol validated and used in detection of DNA and RNA pathogens in Zambia
- 20 cassava genotypes evaluated for resistance to CBSD with results showing varying response levels in Zambia

### 2.5.2 Lessons Learned from Cassava R&D

The involvement/participation of the farmers from the first establishment of the cassava fields was crucial for them to make rational decisions on best varieties based on the preferred traits including performance on disease resistance. Knowledge on disease identification was fundamental, because most of the members of the farmers' associations were able to identify the main disease in their field and report to the research.

## 3 Session Two: Monitoring, Evaluation, Learning and Communication

### 3.1 Keynote 1: The role of monitoring, evaluation and learning of R& D Projects

(Stephen Tembo)

---

The presenter recognised the increased awareness and growing clarity on the role of monitoring, evaluation and learning (MEL) that marks a shift from the previous donor driven approach to a demand-led approach. Within APPSA, there was acceptance of the need to underpin development with sound MEL as well as learning practices. The involvement of the civil society and the community in evaluation should be promoted and strengthened. The action plans for specific countries' M/E & L are useful tools for tracking progress. However, putting the action plan into practice is one thing and following up is another thing altogether. The implementation of the action requires the commitment of the implementers and MEL know-how. The idea of MELs has been on the table for decades, but gaps in its effective performance still persist. It is common for baselines not to be conducted, but midlines and end lines are insisted on poorly constructed log-frames without baseline values. The learning part is often not given much attention. Evaluations are often driven by financers hence they are rarely owned by governments. MEL is the missing link in effective performance of R&D and yet it continues to be given low priority or ignored.

### 3.2 Keynote 2: Knowledge management and communication in R & D Projects

(Dr. Chimwanza Gracian)

---

Knowledge management and communication is the process of creating, sharing, using and managing the knowledge and information of an organization/programme. According to the presenter, it refers to a multidisciplinary approach to achieving organizational objectives by making the best use of knowledge. The use of systematic approach promotes a culture of learning and is a continuous process.

The presentation asserted that systematic reviews (SR) enhance evidence-based research. "...a scientific investigation that focuses on a specific question and uses explicit, pre-specified scientific methods to identify, select, assess, and summarize the findings of similar but separate studies."

Scientists need to relate to SR gleaning experiences from health and bio sciences disciplines that require more time & effort than literature review conducted on primary agricultural research.

There was emphasis on research output quality, access and user skills need to be addressed if produced knowledge and technologies are to be managed & communicated effectively in African R + D institutions; Open Data and Open Science which underpins research and to benefit R +D practice going forward and evidence based decision making which depends on research quality data and analysis

#### 3.2.1 Major Results for M&E, Learning and Communication

APPSA has a well-established common M&E system that is being used by the countries at different levels. APPSA has also developed standardised M&E tools that are used by the countries. CCARDESA is in the process of developing a compendium of technologies for sharing on the

CCARDESA website, D groups and e-rails for ease of access by a broader group of stakeholders in the SADC region and beyond.

### **3.2.2 Lessons Learned from M&E, Learning and Communication**

One of the challenges of APPSA is that the baseline studies for Malawi, Mozambique and Zambia were done very late and were not synchronised. The new APPSA countries should do better in this regard.

There is a need to review the open-access policies to ensure that more people have access to the programme information.

## 4 Session Three: Crop Improvement

### 4.1 Keynote: Crop Improvement

(John Musanya)

---

This Keynote address looked at how crop improvement contributes to enhancing agricultural productivity. The speaker noted that plant science through plant breeding is the main focus. Agronomy in the presentation covered broadly what is referred to as the environment. The presentation highlighted the significance of crop improvement as plant genetics is very important and is the steppingstone where plants are developed which respond favourably to other factors. The presenter stressed that plant breeding is a major contributor to increased food by the application of genetics and traits as contained in a variety is inadequate without other factors of production, but they did make an impact.

The presentation made a reference that through the development of improved varieties, plant breeders in the US doubled maize yields between 1930 and 1966 and more than tripled the 1930 yields by 1995. In other words, farmer average maize yields were increased from 1.6t/ha in 1930 to over 3t/ha in 1966 and to 9.5t/ha by 1995. Today average yields are far higher as farmers' use of hybrids is at 100%.

The presentation concluded that Crop Improvement is a specialized activity that calls for special skills and facilities that are employed to discover and develop new technologies.

Developed countries where agriculture is advanced have invested so much in agricultural research in general.

- The picture seen in our countries is of excellent technologies, but technology transfer appears to be limited. There is need to find out what is happening at farm level.
- Farmers need technical know-how to maximise use of resources including land.
- These RCoLs are not a substitute for National Research Institutions - they could be good at basic research since it is very expensive to undertake but national institutions need high calibre scientists as well to look for compatible technologies for their own countries.
- The population will continue to increase, and people will continue to look for quality products hence there is need for increased agricultural production and this can be achieved through improvements in current agricultural technologies.
- Although crop yield and quality can be improved by disease and pest control by fertilizer application and better cultural practices, such practices are costly and can be cheaply done through crop breeding including the use of biotechnology.
- Consumers will continue to demand more diverse and higher quality diets and need foods that can be transported and stored.
- Natural foods contain what consumers want but these are not found in one plant but scattered all over expressed as traits.
- You need special type of people to find these and extract them and put them into a desired plant. So far through APPSA it has been demonstrated that we have such people in the region. All we need is sustained research.

- Research is an economic activity because it requires the use of scarce resources, but it provides something of value in return.

## 4.2 Major Results for Crop Improvement

### 4.2.1 Improving Nutrition quality in maize in Malawi, Mozambique and Zambia

(Kabamba Mwansa, K. Kaonga & P. Fato)

---

The research indicated that micronutrients are important for human growth & development and that micronutrient deficient statistic indicates as follows:

- Zambia: 54% of the school going children are vitamin A (VAD) deficient whilst stunting & underweight affects 45% & 15% of under five children.
- Mozambique: 2.3 million children below 5 years (38.5%) are VAD & 44% of the children are stunted.
- Malawi: 59% pre-school children with VAD, 57% Child bearing age are VAD, 37% Men are VAD.

In response to the above, current Government responses to micronutrient deficiencies has been the supplementation (under five children), commercial fortification (sugar), dietary diversification and bio-fortification as well. An attempt to fortify maize in Zambia in 2007 by MoH stalled mainly due to concerns in statutory Instrument formulated and refusal consumer Association.

For this project, the general objective was to contribute to improved nutritional status in communities using maize as the main staple food. The specific objective of the Quality Protein Maize (QPM) project was to release maize varieties high in lysine & tryptophan), Provitamin A, to release maize varieties with enhanced Pro-vitamin A (target levels > 15 µg/g) or enhanced levels of beta-carotene, to promote nutrition quality maize to the farming community & consumers

#### Key outputs:

- Two QPM hybrids released in Zambia GV 682P, GV 687P
- Five vitamin A maize hybrids released in Malawi: MH45A, MH46A, MH47A, MH48A and MH49A,
- Six vitamin A hybrids released in Zambia: GV6023A, GV6025A, GV6027A, GV6029A, and GV6017A,
- Two QPM hybrids in the pipeline in Malawi,
- QPMMZ07 & 1 Provitamin A (PROVMZ01) and (MH45A, MH46A) selected and identified for release in Mozambique.

#### 4.2.2 Establishment of core collection of reference varieties and drought tolerant threshold for maize in Malawi, Mozambique and Zambia

(Constantino Senete, Mudenda H. Sikwangala, Caroline Zude and Hastings Musopole)

The presentation noted that Maize is the main staple food crop for rural smallholder households that dominate in the three countries. It noted that the crop is highly susceptible to drought, and climate variability and climate change threaten household and national food security. Several drought-tolerant (DT) maize varieties have recently been developed and disseminated to farmers in the three countries, and there is urgent need to evaluate the merits of these promising technologies for drought risk mitigation.

Since the problems of drought began, different areas of knowledge began to study ways to contribute to the mitigation of this problem. Plant breeders contributed through development and release of drought tolerant varieties. However, there has been a limitation on which growth phase (critical phase) a certain variety is drought tolerant.

Table 1 below provides a list of tolerant varieties selected for further development in Mozambique and Zambia. The selections were made at critical stages of plant growth that are important determinants of productivity in the maize crop.

**Table 1: Tolerant varieties selected for drought tolerance at flowering and grain fill**

Tolerant varieties for (drought at flowering and grain filling)	
Mozambique	Zambia
WE4501	KKS 505
Djandza	SC 633
WE2112	PAN 7M-83
PAN 53	

#### 4.2.3 Development of maize varieties tolerant to drought and heat by use of double haploid technology as a mitigation to climate change in Malawi, Mozambique and Zambia

(Kesbell Kaonga - K. Mwansa and P. Chauque)

The overall objective was to develop maize varieties that can adapt to climate change as a way of improving food security in the three countries. The specific objective was: To develop hybrid varieties that are tolerant to Heat and drought by using double haploid donor inbred lines and develop double haploid inbred lines that are tolerant to heat and drought.

At least nine hybrids had been selected as potential candidates for release in the participating countries are as follows: three drought tolerant varieties, three heat tolerant varieties and three that combine heat and drought tolerance.

Based on this one-year results: entries E24, E37, E9, E35, E23, E38, E34 and E17 were the top yielding hybrids across three countries. Among these G34 or E34, G9, G38 and a local Check G40 (MH36) were the most stable. In addition, the hybrids were tolerant to common maize diseases.

#### 4.2.4 Development of high Iron and Zinc beans with resistant to Angular leaf spot and Common bacterial blight in Zambia, Malawi and Mozambique

(Kennedy K. Muimui, Annie Matumba, Virginia Chisale and Manuel Amane)

---

The presenter highlighted the importance of common bean (*Phaseolus vulgaris* L.) as a legume for direct consumption in Zambia, Malawi and Mozambique, despite the yield gap between farmers (500-600kg/ha and the potential (1500-2000kg/ha) being high.

The low yields were attributed to a number of factors, some of which included low use of inputs, use of unimproved varieties, recycling of seed, and pests and diseases. Among the important diseases in the region were angular leaf spot (*Isariopsis griseola*), common bacterial blight (*Xanthomonas campestris* pv *phaseoli*), anthracnose (*Colletotrichum lindemuthianum*), rust (*Uromyces phaseoli*) and bean common mosaic virus. Beans play an important role as a source of proteins and micronutrients especially iron (Fe) and zinc (Zn) for children and pregnant women.

According to statistics, the malnutrition related stunting of under five children in Zambia is 45% (World Bank, 2009), Mozambique 54% and Malawi 47% (Malawi DHS, 2010). Micronutrients are essential elements needed in small amounts for adequate human nutrition and include the elements iron and zinc.

The project objectives included; to develop bean varieties with high levels of iron and zinc and to develop bean varieties with resistance/tolerance to angular leaf spot and/or common bacterial blight.

##### Key Outputs

Lines with high levels of iron and zinc were developed as well as lines with resistance to angular leaf spot and common bacterial blight. The superior lines were selected by national programmes of the three participating countries. Lines were placed for possible releases in the implementing country. The following lines were earmarked for release CIM ALS-FeZn08-16-6, (Zambia and Malawi) CIM-cbb-FeZn08-30-2 (Zambia and Malawi), ZMBP/12/61-4 (Zambia) CIM ALS-FeZn08-6-2 (Malawi). Mozambique has 4 lines selected

#### 4.2.5 Use of Root and Shoot Traits in Screening Common Bean Genotypes Tolerant to Drought in Malawi, Mozambique and Zambia

(Amane M, IIAM; V. Chisale, DARS; K. Muimui, ZARI; R. Chirwa, CIAT-Malawi; S. Camilo, IIAM; C. Jochua, IIAM; M. Miguel, IIAM; A. Matumba, DARS)

---

The presenter underscored the importance of common bean as a dietary legume and source of income for most of the population in Malawi, Mozambique and Zambia. However, the average yield of the crop in the three countries was less than 600 kg/ha. The legume was mostly grown under rainfed conditions, in some areas with insufficient or unpredictable rainfall. Recent studies suggested that drought would spread to more areas in the coming years thus affecting the productivity of common bean and other crops.

##### Key Outputs

The characteristics of the bean root, which showed correlation with drought tolerance, suggest them to be an important source for breeding programmes, in the identification of parental materials and of developing drought tolerant genotypes.

It was observed that genotypes with deeper and longer basal roots had a greater advantage of yield in limiting water conditions.



The genotypes studied showed good root characteristics for drought tolerance and these characteristics showed a positive correlation with the yield and yield components of genotypes.

Genotypes CAL 96, G 738, G11982, G 1939, SAA 20 and DRK 47 were recommended and have been released in Malawi, SER 124 had been recommended and submitted to the committee for release in Zambia, CAL 96 and DRK 47 have been recommended and proposed for released in Mozambique.

#### **4.2.6 Development and Promotion of Improved Pigeon Pea Varieties for increased and Sustainable production** (Lutangu Makweti)

It was reported that pigeon pea yields remained stagnant during the last 60 years, hence affecting farmers in Asia, Africa, Latin America and the Caribbean who rely on the legume to feed their families and make a living. Pigeon peas are an important source of protein in the diets of more than 1.5 billion people in developing countries. Yet, they are renowned for rich source of food proteins and trace elements and minerals; various medicinal properties because of presence of polyphenols and flavonoids; traditional folk medicine in India and China; and prevents/cures bronchitis, coughs, pneumonia, menstrual disorder, abnormal tumors, dysentery and diabetes among others.

#### **Key Outputs**

Considerable progress was made in making available the seeds of the newly released varieties to the various stakeholders though demand was not met. The newly released varieties had an advantage over old ones-Yield, earliness, disease resistance and tolerance to drought. With these achievements, it is hoped that the production of Pigeon Pea in Zambia, Malawi & Mozambique will scale up and the average yields will go higher once these varieties are adopted; the release of 3 varieties in Zambia and Mozambique will help improve production and productivity; the uptake of PP by small scale farmers which was still very low (less than 10%); basic seed production of MPPV 2 and 3 need to be upscaled; more farmers to be linked to markets and seed companies.

#### **4.3 Adoption of released pigeon pea (*cajanus cajan* (L.) Milli sp.) Varieties in Mozambique Malawi and Zambia**

(Marques Donça, Manuel Amame, Salva Somueque, Esnart Nyerenda)

The project objectives were to promote four (4) already-existing pigeon pea varieties, develop and popularize high yielding pigeon pea varieties and promote the use of good cultural practices using participatory technologies evaluation.

ICEAP 00557, which is a medium maturing with high yields was the most preferred variety by farmers, and this was followed by ICEAP 00040, which has a large grain size. When asked to select a variety if ICEAP 00557 was not available, the farmers then selected the ICEAP 00554 variety.

#### 4.4 Breeding Groundnut Varieties for Multiple Disease Resistance for Market access in Malawi, Mozambique and Zambia

(Lutangu Makweti)

The presentation shared that average ground nuts yield remains at less than 700kg, 800kg, 1200kg/ha in Zambia, Malawi & Mozambique respectively. Production constraints include biotic and abiotic stresses, lack of improved seed and poor agronomic practices. GRD (up to 100% loss), ELS, LLS and Rust (50-70% loss) are among the most important foliar diseases. Rosette caused up to 100% yield losses. 1994-1995 outbreak, approximately 43,000 ha in eastern Zambia were affected resulting into \$4.89m loss and a production reduction of 23% in Malawi

It was also mentioned that GRD is unpredictable in nature but has been reported to cause almost US\$156 million in losses across Africa (Ntare et al., 2001). Among issues to consider regarding this GRV were that;

- Dry spells are conducive for rosette outbreaks.
- Cultural practices to manage GRD are not practiced as many farmers cannot afford pesticides.
- Only breeding for varieties with genetic resistance is promising to be a solution.
- Issues of environment and food safety becoming of increasing concern.
- Increase the efforts put into breeding for resistant varieties and ensure disease management strategies are put into practice by the farmers.

#### Key Outputs

The key issues regarding the multiple diseases' resistant breeds, the MGV-7 and MGV 9 were released in Malawi as CG 9 and CG 12 respectively, the MGV 8 was at a pre-release stage in Mozambique and Wamusanga and MGV 8 under pre-released in Malawi. There were also three released varieties from regional spanish trial in Mozambique (Amena 18, AMM-18 and Mapupulo-18). The project also distributed Groundnut production brochure in Chewa and English version, one TV programme covering almost three million viewers & one Radio tapping to about five million listeners.

In summary, considerable progress was made in making available seed of the newly released varieties to the various stakeholder though demand was not met. The newly released varieties showed more advantages over old ones in terms of yield, earliness, disease resistance and tolerance to drought. With these achievements, it is hoped that the production of groundnut in Zambia, Malawi and Mozambique will scale up and the average yields will go higher once these varieties are adopted.

#### 4.5 Development of Improved Rice varieties in Mozambique & Zambia

(Chitambi Musika, Herminio Abade, Tennyson Mzengeza (PhD))

The presentation shared views that rice production and productivity remained low at about 1.1t/ha in both Zambia and Mozambique (cfs Min. Agric.). Poor access to improved rice varieties for both rainfed, lowland and upland ecosystems contributed to low productivity. Generation of improved rice varieties remains a catalyst for high productivity and production to enhance household food

and nutrition security. Project objective was to develop, release and disseminate improved rice varieties.

The project intended to develop improved rice varieties that are: -High yielding, early-medium maturing, tolerant to moisture stress (drought), resistant to diseases such as blast, consumer preferred grains (aromatic, medium to long grains, palatable, etc.), adaptable to a wide range of environment and to generate germplasm with identified/known traits for future breeding activities.

#### 4.6 Performance of MUCUBA, CXT30 AND IR50404 under rainfed lowland ecologies

(Herminio Abade & Chitambi Musika, Zambia)

---

In Mozambique and Zambia, rice is one of the target commodities considered as the strategic crop expected to contribute to food security. Rice productivity was reported to be very low, with mean yields of about 1.2 t/ha in Mozambique and 1.4 t/ha in Zambia. Farmers in both countries mostly planted traditional landraces. The use of improved rice varieties could increase productivity to at least 3 t/ha.

The overall objective was to develop suitable rice varieties that tolerate and resist abiotic and biotic factors respectively at the same time containing the preferred traits for end users (farmers, processors and consumers). In addition, the project wanted to make available these varieties in traditional rice growing ecologies. Specific objectives included; 1) To develop improved rice varieties for production in the rice targeted areas of Mozambique and Zambia; 2) to multiply foundation seed of released varieties and; 3) Maintain breeder's seed of improved varieties and to purify mixed commercial varieties.

#### Key Outputs

The Mucuba, IR50404 and CXT30 varieties showed superior yield and grain quality when compared to the C4-63 variety that was used as the control in this study. The two varieties (IR50404 and CXT30) had early mature characteristics and could be produced more than once a year. During participatory selection, farmers preferred these three varieties because of acceptable grain quality that included average shape and length, average cooking time, loose when cooked, and moderate aroma (IR50404 and CXT30) to strong aromatic aroma (Mucuba).

#### 4.7 Lessons Learned from Crop Improvement

The effects of climatic change and emerging threats (FAW, MLND) during the period of APPSA implementation calls for inclusion of key traits in terms of resilience for varieties to be used by farmers. The use of mega-environments by breeders in Malawi, Mozambique & Zambia has assisted in:

- product development (inbred lines and hybrids) & joint trial evaluation in participating countries.
- targeting technologies for release in similar environments in Malawi, Mozambique & Zambia based on maturities and ecologies.

Limitation in number of varieties released may be attributed to variety release procedures in the participating countries. Germplasm exchange & joint site testing was accomplished due to good

quarantine polices among the three countries and this broadened germplasm diversity & selection of new varieties.

Technical regional collaboration enhanced or shortened the process of variety development. The Countries were able to share hybridized genotypes at advanced generation, for example F5, as was the case with Mozambique. For rice, the promising lines were proposed to be included in the National Rice Variety Trial. The release of improved rice varieties has increased options for farmers to access varieties of their choice fitting in their environments. Early generation seeds are now with Breeder Institution (ZARI)

Pest management in general has been observed as a major challenge in farmers' fields, while it is observed that the need for establishment of an economic and sustainable pest management for pigeon peas is particularly critical.

There is a need to validate data on pigeon-pea maize intercropping on a wider scale as well as to generate data and information on a wide scale.

Variety release in the APPSA countries has been made easier by the SADC seed harmonization program.

The pivotal role of collaboration with the CGIAR for germplasm and variety released was emphasised for sustainable achievements in crop improvement.

Significant yield gap of the varieties disseminated to farmers between the results obtained in breeding trials and on-farmers' fields continues to be an issue of concern. This state of affairs is attributed to the absence of pro-active engagement of breeders with agronomists early enough in the breeding process resulting in failure to develop appropriate agronomic packages for released varieties to address aspects related to improved crop management for narrowing the gap and achieving more stable yields.

## 5 Session Four: Integrated pest and disease management

### 5.1 Keynote: Integrated Pest Management (IPM)- relevance to GAPs for Sustainable Crop Production

(Dr. Joyce Mulila-Mitti)

---

The Keynote address made reference that more recently quality of agricultural production has become more important due to considerations regarding globalization of trade and markets and need to maintain international standards, changing lifestyles and environmental concerns. Good Agricultural Practices (GAPs) are composed of a series of inter-related protocols, to apply in on-farm production and post production processes that are designed to improve sustainability of crop production in the scenario of ever-increasing agro-ecological zone (AEZ) fragility.

Economically and efficiently produced sufficient, safe and nutritious products Sustain and enhance natural resources Maintain viable farming enterprises and contribute to sustainable livelihoods and meet cultural and social demands of society.

Therefore, Integrated Pest Management (IPM) is an ecosystem approach to crop production and protection that combines different management strategies and practices to grow healthy crops and minimize the use of pesticides: Integrated Production and Pest Management (IPPM)

The presentation highlighted such implications for development and adoption of GAP such as s successful implementation of GAPs depend upon; developing the skill and knowledge bases, continuous monitoring and analysis of performance, and use of expert advice as required.

The adoption of GAPs is an attempt to rescue agriculture from its current situation, making it benign to the environment, assuring the supply of better-quality products more acceptable to consumers and improving livelihoods.

### 5.2 Major Results for IPM

#### 5.2.1 Pathogens limiting cassava culture in Angola, Zambia and Mozambique

(Rabson Mulenga and Jamisse Amisse)

---

The presentation asserted that the limited regional level (Angola, Mozambique and Zambia) diagnostic capacity for cassava diseases had been common. Furthermore, there was limited information on the diversity and geographical distribution of cassava pathogens infecting cassava in the three countries, limited diagnostic and laboratory capacity for cassava diseases and lack of developed IPDM in the three countries.

The project was designed to: generate information on the nature and distribution of biotic factors (insect pests and diseases) limiting cassava cultivation in three countries (Angola, Mozambique and Zambia); improve diagnostic capacity of laboratories in the three countries to detect different cassava pathogens and where possible, develop IPDM.

## Key Outputs

Based on the findings, all the four diseases; CMD, CBSD, CBB and CLS occur in Zambia and/or Mozambique, prevalent among these is CMD. CBSD is an emerging important disease of cassava requiring urgent interventions to manage its spread into regions currently not known to be infected. Use of biotechnology to find possible sources of resistance.

### 5.2.2 Breeding for Maize Leaf Necrosis Disease tolerance

(J.I.G. Masangwa. Collaborators: K.K. Kaonga & L.M. Suresh)

---

Maize Leaf Necrosis (MLN) is a new viral disease of maize caused by the double infection of maize plants with MCMV and any of the cereal viruses in the Potyviridae group (CIMMYT, 2003). MLN has a potential of destroying maize crop. MLN is in Kenya (Wangai et al, 2012), DRC, Ethiopia, Rwanda, Sudan Tanzania and Uganda, (Wangai et al., 2012a, Adam et al. 2014 Lukanda et al., 2014).

The disease has not yet been reported in the APPSA countries, but its presence in Tanzania and DRC pose a big threat to Malawi's and other APPSA countries' maize industry.

Use of disease resistant varieties is one way of reducing losses caused by MLN. However, Malawi and other APPSA did not have any known maize variety resistant to MLN hence this work was initiated

The main objectives were to: 1) Develop maize hybrids that are resistant to MLN, grey leaf spot, E. turicum leaf blight and rust diseases suitable for the major agro-ecological regions; 2) Develop maize hybrid varieties resistant to MLN, DM, TLB and ear rot suitable for the major agro-ecological regions of the three partner countries; 3) Screen already available cultivars and new hybrids for resistance to maize lethal necrosis and other major common diseases; 4) Promote the developed disease resistant hybrid varieties for the farmers in the three partner countries; 5) Build capacity of research staff, extension workers and small holder farmers.

## Key Outputs

- Through the project activities. Germplasm was mobilized and this is being utilized in breeding program in the region.
- The project managed to generate and release the first MLN tolerant hybrids namely MLN-MH56 and MLN-MH57.
- Also developed and released three high yielding multi-disease resistant hybrids (MH53, MH54 and MH55).
- Improved capacity of extension staff and farmers to deal with such diseases.
- Collaborations between national research institutes, research-extension and that between research and CIMMYT improved.
- Though that was the case the project failed to increase breeders seed for all the released varieties and fail to disseminate information about the released hybrids.

There is a need to popularize the released hybrids through mounting demonstrations, increase breeders seed for the released varieties and share materials with sisters APPSA countries.

### 5.2.3 Efficacy of Chem TICA Pheromone Trap Against Fall Armyworm (FAW) *Spodoptera Frugiperda* (J.E. SMITH) (LEPIDOPTERA: NOCTUIDAE)

The presentation mentioned that the specific objectives of the project were to: 1) To strengthen national and regional crop pest early warning systems; to create public awareness about FAW; 2) To evaluate mild synthetic insecticides for FAW control; 3) to evaluate botanicals and other indigenous products for FAW control.

#### Key Outputs

- The ChemTica Pheromone with Vestergaard treated net attracted the FAW moth in the catch traps in all the sites as opposed to none baited catch traps.
- The black and yellow net lined catch traps had 78.7% catches across the sites as opposed to non-netted catch trap (control) that had 11.3% catch.
- The combination of work of the lure and yellow colour of the net material elicited larger responses than those evoked by lure and black net materials.

Throughout the project, there was a need to incorporate the Sub project in APPSA, exchange of technical information among scientists, develop Fact sheets, fliers, posters in all the seven major languages of Zambia in FAW identification and management, training of extension and lead farmers in FAW identification and scouting.

It was therefore recommended the local trap can be used in IPM management of FAW especially by small and medium scale farmers in the region.

### 5.3 Lessons Learned from IPM

IPM technologies constitute a major component of Good Agricultural Practices (GAPs) that contribute to the achievement of significant sustainable agricultural productivity gains. IPM technologies have synergistic effects with many key agronomic practices (good quality seed, optimum fertility status, crop rotations etc.).

The appreciation and good knowledge of the various relevant International Conventions for Pesticides Risk Reduction (Basel, Rotterdam, Stockholm, the Code of Conduct for Pesticides Management, IPPC) are required among researchers and key partners to achieve effective pest management and for fostering safer trade of agricultural products.

For establishment of strong IPM programmes to support R&D activities, there is need for active engagement of the National Plant Protection Organization that among other responsibilities have the role of leadership for phytosanitary and plant quarantine services in the countries. For effective engagement, adequate funding for NPPOs is essential to ensure that key activities such as surveillance and contingency planning are not undermined.

## 6 Session Five: Mechanisation, post-harvest and value chain

### 6.1 Keynote: Post-harvest processing and value addition

(Prof. Brighton Mvumi)

---

Emphasis was made that climate change, characterized by increased temperatures and extended droughts and can influence geographical distribution, population dynamics, and the status of stored product insect pests (Stathers et al., 2013). Hotter climates are likely to increase over-wintering, high mobility, rapid population growth, increased species diversity, and increased no. of generations of stored product insect pests (Sharma, 2010; Moses et al., 2015). Unimodal rainfall pattern emphasises PHM importance to overall maize supply.

Increasing agricultural production without first resolving handling and storage issues only results in greater overall losses

The presentation highlighted post-harvest constraints as; Lack of skills in managing increased quantities of grain, Lack of accurate info about pests e.g. LGB, Prevalence, ecology, damage & management, apparent lack of efficacy of current pesticides and misuse; low emphasis given to food safety issues in postharvest management e.g. improper application of pesticides and aflatoxins; lack of properly designed loss assessment studies just to mention.

It also made reference to the fact that adoption can be enhanced by: formulating a postharvest policy to support sustainable uptake of climate smart postharvest technologies, tax exemption/concessions on imported hermetic storage facilities (hermetic bags, Silobags) and manufacturing material (galvanised sheets), more private sector engagement e.g. local/regional manufacturing and distribution of the hermetic containers, avail financing mechanisms for industry and farmers, need widescale awareness raising; media plays a critical role, continuous training (including Agribusiness and follow-ups) etc.

In summary, there was emphasis to continuously identify alternative pest control options e.g. resistance, promote improved storage facilities (metal silos, hermetic bags), facilitation of access to loans by farmers in groups to invest in improved storage facilities, PPP for sustainable development to stimulate demand for storage facilities, group formation farmers/artisans for collective bargaining and training in group dynamics and leadership skills, Innovative approaches to dissemination of PHM info and technologies and collaboration & coordination at institutional, national, regional, continental and intercontinental.

### 6.2 Major Results for Mechanisation, Post-Harvest Processing and Value Addition

#### 6.2.1 Improving rice processing and nutrition through supplementation of rice sub products to rural women and orphan children in Mozambique, Malawi and Zambia

(Cheila Klironomos Sequeira)

---

It was noted that rice was one of the major food crops in the world and provided 20% of the world's dietary energy supply (FAO, 2004). The most common cultivated species and import-



ant cash crop in Malawi is *Oryza sativa*. In Malawi, it was the 2nd important cereal after maize and was mostly grown in Lake Malawi lakeshore, Lake Chilwa plains and lower shire valley in districts like; Nkhotakota, Dwangwa, Karonga, Salima, Nkhatabay, Mulanje. There are various aspects of rice grain quality that are important to consumers and the market place such as grain appearance, milling quality, nutritional quality and eating and cooking qualities (ECQ).

- These qualities depend on the compositional properties of the rice.
- The consumer preference for rice is mostly for steamed rice.
- There is potential for adding value to less preferred varieties.
- The quality characteristic for processing rice into derived products are different.
- This research will help to identify rice varieties that can be targeted for derived product processing.

The goal of the project was to improve nutrition of rural women and orphan children through the introduction of rice-based products processing technologies in Mozambique, Malawi and Zambia. The objectives included; 1) the suitability of available rice varieties for processing into value added products; 2) To validate the rice utilization technologies through the development of recipes for rice-based products, and; 3) To disseminate the rice products recipes to orphan children and rural women. Implementation of the various activities ranged from fully done to partially done as well as undone activities. No dissemination activities were implemented.

### Key Outputs

While several of the planned sub-project activities were not implemented, some results particularly for rice product development were obtained and are highlighted below.

- Characterization of rice consumption patterns among producers and urban consumers in Malawi looking at frequencies, amounts, types of dishes/products, variety preferences and pricing, recommendation for new products, varieties and raw materials
- Rice product development that addressed rice-based food products and screening potential food prototypes through a desk study of rice-based food products. Some of the products developed include rice balls, rice scones, rice banana fritters and flour blend and roti.
- The study included addressing aspects of target consumers, type of ingredients, potential snacks for school children, potential for sale and quality and sensory evaluation of the rice products.

### 6.2.2 Improved Grain Storage Structures for smallholder farmers in Mozambique and Zambia

(Nswana Kafwamfwa)

---

The presenter reported that post-harvest losses (PHL) accounted for more than 35% of grain losses annually (FAO, 2011) and this was mainly due to poor and inadequate improved storage infrastructure (World Bank and FAO, 2011).

The objective of this was to evaluate the effectiveness of Polyethylene silo tanks (PST), Super grain bags (SGB) and Metal silos (MS) as improved storage structures for smallholder farmers in Mozambique and Zambia. Interventions had been made in both countries e. g Mud brick silos.

## Key Outputs

The improved storage structures introduced were able to keep the grain free from weevils and other storage pests for more than six months both under researcher and farmer management.

SGB, PST and MS were 95 %, 85% and 89% more effective than the Traditional (Local grain Bags). It was recommended that these storage structures are promoted as the alternative materials to be used for the storage of grain in Mozambique, Zambia and the region.

## 6.3 Lessons Learned from Mechanisation, Post-Harvest Processing and Value Addition

Collaboration with breeders was very productive for the project activities on post-harvest, processing and value addition. It was discovered that the current rice varieties have great potential for value-added products. It was observed that utilisation and market development components were imperative to ensure sustainability while marketing and private sector uptake of value-added products were essential for increased consumption.

Sensitisation and monitoring of farmers regularly by extension workers essential for post-harvest, processing and value addition activities as it was observed that farmers tend to open storage structures and eat stored grain especially if traditional bags are used.

The implementation of the projects was affected negatively by the M&E system that did not have sufficient indicators for value chains-related interventions.

## 7 Session Six: Climate Smart agriculture- Conservation Agriculture

### 7.1 Keynote: Climate smart Agriculture

(Sina Luchen)

---

This presentation made a strong call for adoption of climate smart technologies to counter the ever-increasing impact of global warming. It was shared that an estimated 70% of people in Southern Africa derive their food and nutrition security and livelihoods from Agriculture. The fre-

quent occurrence of seasonal rainfall deficits interplays with the use of inappropriate production practices by farmers- resulting in lower productivity and production has resulted in an increasing number of food insecure people in the region. It was further reported that Southern Africa was in the grip of a climate crisis and food insecurity with an approximation of 41 million people at eminent risk, with 11 million of these are experiencing crisis or emergency levels of food insecurity (IPC Phases 3 and 4) in nine countries- due to deepening drought and climate crisis. Therefore, urgent transformation of production systems to make them more climate resilient was needed.

The presentation concluded that Knowledge sharing, advocacy and innovation would be at the centre of this model intervention. There was a niche for everyone; Research would be critical for defining and tailoring of context specific CA that fits various production systems while being acceptable to specific farmer profiles- an aspect that is critical to increased adoption

## 7.2 Major Results from Climate Smart Agriculture

### 7.2.1 Disease and Pest Challenges in Maize Production under Conservation Agriculture Cropping Systems; What do we learn?

(Mathias Tembo)

---

Conservation agriculture (CA) as aspect of resource-efficient agricultural crop production is centered around three principles: 1) Minimum or no mechanical soil disturbance; 2) Permanent organic soil cover (crop or a dead mulch of crop residues); 3) Diversified crop rotations. It has become a revolutionary practice and alternative to conventional agriculture characterized by clean seedbed without crop residues, burning of maize stover etc. The intensification of the CA practice is in some cases associated with opportunities for certain pests and diseases to thrive and also results in conflicting and unclear statements on the effect of tillage practice upon disease/pest survival and infection / infestation of subsequent crops.

The project objectives had been; to assess the maize leaf diseases and pests of economic importance under conservation practice (CA) and conventional practice (CP); to assess the effect of continued maize crop residue retention on disease and pest build up; to evaluate performance of different maize varieties under varying CA practices in the different agro-ecological regions; and to promote the adoption of CA technologies and the compatible maize varieties.

## 7.3 Lessons Learned from CSA

The project underscored that there had been significant gains of conservation agriculture practice after 3-5 years. However, the lack of training of extension staff on disease and insect scoring affected the collection of data at critical moments when funds for implementation were unavailable.

But most importantly, the multi-disciplinary approach enhances quality and generation of results, the long-term effects of conservation agriculture should be used as basis for decision making. The scaling up of maize conservation cropping system across the regions should be encouraged especially through strong collaboration between farmers, extension officers, NGOs, policy makers in dissemination of the relevant technologies.

## 8 Session 7: Social Economic Studies

### 8.1 Major Results for Socio-Economic Studies

#### 8.1.1 Determining the availability and accessibility of APPSA-promoted technologies by smallholder farmers: An Agro-dealer Perspective Analysis in Zambia

(Fredrick Choma)

---

The presentation made note of the view that while initiatives to increase the availability of improved agricultural technologies in APPSA countries had been undertaken, it was not yet apparent whether farmers were accessing the improved technologies being promoted. The World Bank Implementation Support Mission and CCARDESA noted this shortcoming and advised that the measurement of the PDO Indicator 1 be revisited to provide reliable data that can be verified.

The overall objective of the study was to estimate the extent and intensity of technology use by smallholder farmers in APPSA project areas of Zambia, Malawi & Mozambique. The aim of this Study was to evaluate Agro-dealer and Farmer Response to Technologies promoted by APPSA between 2014 and 2019.

#### Key Outputs

The project noted that 88.8% of the agro-dealers are aware of environmental and social safeguards of agro technologies. Furthermore, 17.5% by way of burying and burning as well as emergency response mechanisms in case of agro-chemicals spillages, and 6% are aware of the Zambia Environmental Management Agency (ZEMA) safety guidelines.

Evidence that improved technologies promoted by APPSA between 2014 and 2019 have adequately been responded to by Agro-dealers and farmers has been established.

Improved Maize varieties are the most stocked by agro-dealers and accessed by farmers followed by the improved varieties of soya bean and groundnuts and 31 out of the 34 improved varieties listed for promotion by APPSA were acknowledged by Agro dealers (94%). The probability that 94% of the total number of improved varieties listed for promotion by APPSA are being stocked by agro dealers and accessed by farmers is quite high.

#### 8.1.2 Determinants of adoption of improved varieties of maize, rice and beans in Malawi, Mozambique and Zambia

(Crispin Kapunda and Kennedy Machira)

---

The presentation indicated that there had been initiatives undertaken to facilitate technology uptake under APPSA for more than 5 years. Participating countries (Malawi, Zambia and Mozambique) had been encouraging smallholder farmers to take up the improved cereals and legumes technologies, namely, maize, rice, beans and soybeans in order to improve food security and economic livelihoods of the people.

However, the question that needed an answer was whether the farmers were adopting these promoted technologies alongside persistent hunger and food insufficiencies among the people across the countries.

The need to establish an answer to this question spurred the participating countries to examine the Socio-economic determinants affecting technology(s) adoption by farmers.

Specifically, the objectives were to; estimate the adoption rates of improved maize, rice, soya bean and common bean varieties promoted under APPSA between 2013 and 2018; establish the determinants of acceptance and adoption of improved cereal (maize, rice) and food legume (beans, soy bean) based technologies among smallholder farmer across the countries and to investigate challenges associated with the adoption of APPSA promoted technologies.

### Key Outputs

There had been a higher increase in area under production for adopters of beans, maize and rice compared to non-adopters in last 3 years (2015-2017/18). Marginal change in seed quantity planted for maize could be attributable to: Highly competitive maize seed sector and widespread subsidized maize input programmes that enable majority of vulnerable hhs (including non-adopters) to access seed. There has also been an increased intensity of use is observed for improved beans and rice (mainly in form of increasing quantity & area planted).

In Malawi Risk management strategy practices were found not doing a lot in influencing adoption positively across the technologies introduced in the country.

Age, value of sales, number of extension contacts, years of growing crop, education level, crop field size, access to labour saving implements (ripper), affiliation to farmer group are key decision variables for adoption and showed positive effects on adoption. Family size, gender (if female), total area cultivated to other crops, were negative determinants of adoption.

Intensity of growing improved crop technologies for income generation can be influenced by challenges farmer face especially product deterioration, access to transportation, education level of household, and quantity of seed planted.

### 8.1.3 Profitability of Maize, Rice and Common bean in Mozambique, Malawi and Zambia

(Joao Mudema)

---

In Mozambique, the agriculture sector was reported to be the mainstay of the economy and to contribute almost 23% of the country GDP and employed more than 80% of the total labor force. The staple food crops have been maize, cassava, beans and rice over decades. Rice, maize and common beans have been important on the HH diet as they contribute more than 8%, 22% and 22% of the in-take of calories, respectively. The profitability of the production system is key to attract other actors to the rice, maize and beans subsector and contributes to the improvement of the performance and sustainability of the crop value chain and improve the sector competitiveness in terms of comparative advantage. If APPSA aims to increase agricultural productivity in the 3 countries, then, productivity should be associated with profitability and this study provides evidence of APPSA contribution on crop profitability.

The objectives of the project included brief characterization of rice, maize and common bean production systems; analyze the cost structure of rice, maize and common bean production in the target areas; assess the profitability of rice, maize and common bean production in the APPSA intervention area.

### Key Outputs

Rice, Maize and common bean production seemed to be a male dominated activity. In rice irrigated system the peak of labour demand was December, January and February, while in rain-fed

system the peak occurred from October to December, second week of January and May to June. The peak of labour demand in irrigated maize system occurred in October, January, February and March, while for rain-fed system it is include the month of April.

The project noticed and an increase in 5% of the output price. It was observed that the rice-based system was more profitable as the BCR increase in 6% and 7% in rain-fed rice and irrigated rice systems, respectively. In Sussundenga district, there was a maize irrigated system that was profitable to produce maize, while in Angonia, it was not profitable as the benefits from maize farming were not covering the total costs incurred by farmers.

By reducing in 5% the prices of fertilizers, NPK and UREA, it may increase in 3% the profitability of maize enterprises in the study areas. The variable costs are main component on cost structure in rice, maize and common bean-based enterprise, as in all district covered by this study the variable costs accounted for the largest proportion (above 90%) of the total costs

In both rice-based systems (irrigated and rainfed), it was profitable to produce rice and maize, taking into account prevailing conditions and the introducing small tractors to be used in land preparation. That would only increase profitability of rice farming in Namacurra district by around 3%.

It was mentioned that proper engagement in research, generation and dissemination of drought tolerant maize varieties with at least 3 tonnes per hectare at smallholder farmers conditions will increase significantly the profitability of maize farming in Angonia district, as well as in drought prone areas. In both common bean-based systems (irrigated and rainfed) is profitable to produce taking into account prevailing conditions.

## 8.2 Lessons Learnt from Socio-Economic Studies

Intensity of growing improved crop technologies for income generation can be influenced by challenges farmer face especially product deterioration, access to transportation, education level of household, and quantity of seed planted.

Early involvement of Agro dealers and Agricultural input suppliers to be part of an innovation platform in R&D projects should be an entry strategy of promoting improved technologies.

Train agro-dealers to improve on safe use of agro inputs – handling, storage & disposal

Awareness creation on available promoted technologies so that agro dealers become knowledge experts to serve farmers better.

- Enhance farmer trainings coupled with farmer access to information on varieties and associated agronomic practices.
- Need to improve seed availability and farmer access.
- Dissemination efforts need to take into consideration farmer variety preferences in choice of variety to promote.

## 9 Session Eight: Technology dissemination and seed system

### 9.1 Keynote: Technology Dissemination and Dissemination Pathways

(Kolawole Odubote, PhD)

---

Technology is the science, knowledge, techniques, skills, methods, tools, processes, used in the production of goods or services in the accomplishment of a set of objectives or to solve a problem. Dissemination is the process that involves moving an Innovation from one party (origin) to another party (end-user or where required). Technology Dissemination involves wide range of services (information, awareness, promotional, advisory, knowledge, technology transfer, training, education etc.).

The overall Objective is to contribute to the effective and efficient information dissemination and uptake of responsive innovations in order to increase sustainable agricultural production and productivity that assures household income, gender sensitivity and national food and nutrition security.

Under APPSA, the technology dissemination activities are designed to encourage the participation of diverse partners, and are expected to focus on: improving the content and accessibility of technology messages and knowledge products, including the use of information and communication technologies; improving the capacity of advisory service providers through technical training of Lead Farmers, extension agents, and other actors in private sector or civil society; strengthening the capacity of dissemination officers or technology transfer specialists in research institutes, to enable them to engage more effectively with farmers, extension agents, and advisory service providers; establishing or improving platforms for dialogue and consultation around technology priorities with farmers, private sector, and civil society; improving farmer-research-extension feedback mechanisms to obtain a better analysis of farmer preferences; exchanging information and experiences with other participating countries; conducting research on technology dissemination methods or tools, including those targeting gender specific issues such as household nutrition and food safety.

It was observed that implications of the Technology Dissemination Model on Dissemination Pathways included; the technology itself will influence the dissemination pathway(s) to adopt, the farmers' profile and information needs should be considered in determining the information dissemination pathway to adopt (Horizontal or Vertical) such as: farmers' skills, needs and resources, cost and benefits of the technology, gender, social capital, socio-cultural practices, access to markets and credit among others, expected feedback may also play a role in determining the information pathways such as value chain actors may influence dissemination pathways, Message around the Technology (Specific or General) and the Disseminator and or the funding agency.

However, an enabling environment especially policy environment that provides enabling setting for all Value Chain actors especially private sector is highly essential in this initiative.

## 9.2 Major Results for Technology Dissemination

### 9.2.1 Enhanced dissemination of improved technologies for increased production

(Katumba Mutandi, Godfrey Liwewe and Belarmino Divaz)

---

The presentation shared views that Legumes and Cereals (Maize & Rice) remain important crops in Zambia, neighboring countries like Malawi and Mozambique. The low productivity among smallholder farmers was due to; low use of fertilizers, use of local low yielding seed varieties and poor Agricultural Management Practices.

Agriculture Research Institutes (ARIs) in the three countries have developed and released several technologies. However, there has been limited scale of dissemination to farmers and low adoption among smallholder farmers.

The APPSA dissemination projects sought to make available the technologies to smallholder farmers through dissemination and increase adoption of released and promoted technologies. It covered Zambia within 29 districts, Malawi in 20 administrative districts and Mozambique in 29.

#### Key Outputs

Seed drops catalysed farmers interest in taking up the technologies and the timely seed availability and access affected technology uptake (variety) as well as inclusion of promoted technologies on government programs like FISP, FSP increases adoption. There was also increased involvement of other partners key in having a wider beneficiary outreach. Future dissemination programs should make use of the electronic platforms such as the Smart Zambia ZIAMIS E-extension platform.

### 9.2.2 Field performance evaluation and dissemination of small tractors in Conservation Agriculture in Central Mozambique and Malawi (CA-P06-2016)

(Domingos José Brás Dias)

---

It was mentioned that smallholder farmers in Tete-Mozambique and Malawi spend the highest proportion of their working time preparing ridges using hand hoes and this results in high drudgery. The drudgery associated with the land preparation results in loss of productive time that could otherwise be spent on other activities, and also results in youths and women refraining from engaging in farming as a business undertaking. Mechanizing these activities with accessible technologies enabled farmers to increase their labour productivity and crop yields.

#### Key Outputs

There was a plea to continue the CASI activities in Namacurra Recol areas (Morrumbala, Nicoadala and Mopeia districts) using available protocol (as small tractors are available) in consortia with government funds, Vietnamese Aid, AGRA project and National Research Fund (FNI) and possibly APPSA 2 funds.

### 9.2.3 Strengthening Legume seed delivery systems in Mozambique- The role of promotional campaigns on technology dissemination and adoption

(Magalhães A. Miguel)

---

The Project goal was to bring about significant increase in the productivity and production of four grain legume crops, through quality seed provision. Specifically, the project objectives were; 1) To capitalize the use of high quality seed of improved legume varieties through enhancing seed



production of early generation seed establishment of local seed delivery system; 2) to strengthen national programs' capacity for policy support, inspection and certification services both at country and regional levels; 3) to enhance distribution of quality seed; promote the use of improved seeds for common bean, pigeon pea, soy bean and cowpea by improving access to quality seeds by smallholder farmers in the three countries; 4) to facilitate the establishment of retail outlets and agro-dealers in the communities, where farmers can easily access improved and quality seed and promote small and medium seed companies to enter in legume seed business.

### Key Outputs

Collaborative projects under APPSA program showed to be very effective in knowledge and material sharing among participating countries. This model can be followed in future initiatives including the APPSA II.

#### 9.2.4 Dissemination Pathways

(Henry Msatilomo)

---

The presentation shared that a lot of innovations have been shaped and maintained by Agricultural Research Scientists. Effective transfer of this knowledge to other sectors for use in the creation of economic, cultural, social, and personal value in society as a whole is essential in order to optimally benefit from the rapidly accumulating research efforts and results. The demand for the innovations is high. This calls for the effective and efficient means of communication for the farmers to maximise the benefits. APPSA facilitated the processes of making the innovations available to the users.

### Key Outputs

CCARDESA organized a series of consultative Workshops in Malawi, Mozambique and Zambia whose objective was to define and harmonize the technology Dissemination Pathways.

### 9.3 Lessons Learned from Technology Dissemination

There was difficulty in effective communication among PIs and Co PIs as well as the High turnover for Dissemination Specialists across countries. Dissemination came as afterthought. Weak at the start of the project as it was not visible in the CN and the challenges in understanding the project RF. There was need to communicate messages put in languages that farmers understood.

To increase adoption, promoted varieties should be introduced on government input support programs e. g FISP, FSP.

Seed companies and seed growers should invest more in seed production to improve seed access and availability.

Seed drops should be included in all future dissemination efforts to catalyse uptake of technologies.

Farmers engagement and key partners, support with Memorandum of Understanding where roles and responsibilities were well defined. Support from local government was very critical in selecting communities and farmers and Engagement of mechanization parks and training centres very important.

The engagement of Community seed producers is an important component to increase availability and access of high-quality seed of improved varieties.

To strengthen legume seed delivery system required the involvement of key stakeholders specially Community seed producers, and not to rely on seed companies alone.

## 10 Summary of Major Project Challenges

- The perception of women and youth to technologies in helping to reduce drudgery and improving their livelihoods not yet assessed.
- Limited provision of foundation seed of some legumes (e.g. Pigeon pea).
- Irrigation system for effective production of basic seeds.
- Infrastructure for Storage of seed after harvest.
- Costs of Inspectors and Schedule.
- Late disbursement of funds in the early years of the project.
- Cost of improved seeds still high for several farmers.
- Mobility for field staff affected effective extension.
- Inadequate Field staffing levels.
- Inadequate availability and access of some promoted technologies affected uptake e.g. Legume seed.
- Communication among PIs and Co PIs.
- Challenges in understanding the project RF.
- Messages put in English not used by farmers.
- Lengthy procurement process.

### 10.1 Summary of Major Recommendations

- Future dissemination programmes success should make use of the electronic platforms for mass dissemination in languages that farmers and all stakeholders understand. The introduction of the APPSA mobile application will go a long way in addressing this challenge.
- In all countries, seed companies and seed growers should invest more in seed production to improve seed access and availability to all farmers. Seed quality control through engagement of seed inspectors should be mandatory to ensure seed quality. There should also be engagement of community seed producers is an important component to increase availability and access of high-quality seed of improved varieties, and agro-dealers must reduce the size of seed packs to reach more farmers.
- There is need for the ministry/other stakeholders to improve mobility of extension staff and improve on remuneration of scientists.
- Further dissemination of new released varieties should continue (promoting their opinions and perceptions).
- Develop a training program for farmers in the field of seed production locally of the varieties selected by farmers. In addition, germplasm collection and field selection helped to acquire genetically pure varieties.

- The need to continue sensitizing and building capacity of various players in the maize, legumes and rice value chains cannot be overemphasized. Research, generate and disseminate drought tolerant varieties to increase the adaptative capacity of smallholder farmers to lead with climate change and increase profitability.
- Create awareness among APPSA smallholder farmers about machinery use for land preparation and other farming activities.
- Promote small-scale processing technologies to add value of food products and increase the output prices.
- Create awareness among policy makers to develop a subsidy package to facilitate input transportation to the production areas to reduce input costs.
- Marketing and Private sector uptake of value-added product to increase consumption.

## 11 Way Forward- Country Specific

Within acknowledgement of the fact that the project had come to an end, it was critical to reflect on all the good work and pave ways in which sustainability of all the activities in the respective countries can be ensured. Each country therefore was requested to make pledge on how such best practices and lessons are not lost.

### 11.1 Lesotho

Lesotho stated that it was in position to continue learning from the best experiences and weaknesses before any project is implemented. The results from various studies, the baselines and the sharing of best practices, challenges and lessons learned places Lesotho in a better space to do well in the APPSA family.

Furthermore, Lesotho viewed projects as an investment for future efforts but beyond money in the form of food security, sustainable research and regional collaboration. Such initiatives go beyond the project and the member countries especially through research capacity to spearhead best practices around all the information gathered. Quality research, technology, capacity building are all good benchmarks for small countries like Lesotho.

### 11.2 Zimbabwe

Zimbabwe was particularly grateful for the invitation as part of this wonderful family. It has been an active learning process for Zimbabwe and has often been keen to participate in several regional initiatives and there is therefore an ongoing interest to join the APPSA family.

The peer mechanism, monitoring and evaluation and learning, the dissemination of the technologies, the issue of harvesting and pest control for emulating and this engagement will continue to encourage Zimbabwe as it finds its foot with the programmes.

### 11.3 Malawi

For Malawi, the core issue was around sustainability. It was important to acknowledge that regional centres of leadership, the infrastructure and research equipment that was left behind would facilitate implementation of research programmes, so that all the knowledge and information could be used as baseline to enhance further dissemination.

The use of modern technology in agriculture was an emerging issue especially in the face of climatic change. There was continuous need for collaboration and effective coordination of member states through the use of these project findings and results to encourage climate smart technologies in agriculture.

Collaborative publication of key issues should continue especially through developed networks as well as sharing information within the region especially in the Common Market for Eastern and Southern Africa (COMESA).

Furthermore, Malawi stated that it was necessary to encourage and lobby governments to fund and sustain the project gains through different platforms as well as engaging the public-private partnership as evidenced from all the research projects.

Finally, Malawi encouraged domestication of regional policies to enhance the adoption of the developed technologies and best practices as well as lessons learned and ascertained that it would be an ongoing work.

### 11.4 Mozambique

For Mozambique, there was need to continue the good work of this project and where need be, internal and external resources should be mobilized so that the sustained gains are not lost. The government of Mozambique pledged to allocate 10% of government budget to agriculture. This is a positive direction that will enhance and sustain the good deeds of this project.

More emphasis will be placed at ministerial level in the Mozambican government to enhance research and best practices, climate smart agriculture technologies, building capacity at agriculture research institutions to continue the programs, as well as operationalizing leadership and enhancing international and regional support.

Mozambique also looks to create and strengthen linkages in the private sector, capitalize and attract other similar initiatives through collaborations.

The Government would create and plan to involve all stakeholders in the dissemination of the identified technologies to increase the adoption levels especially in all areas. The government will also ensure that the commodity value chains with great emphasis on the markets are enhanced and supported.

In the coming years opportunities shall be shared with the government through the strategic plan for agriculture and research particularly many of these areas of the project will be the country's main focus.

## 11.5 Zambia

For Zambia like all other countries, maintained that partnership research agenda was key. The sustained gains in conservation agriculture as seen shall be supported and sustained while institutional capacity in the research training and development to promote most of these technologies would be enhanced.

The sustained institutional capacity in monitoring and evaluation and learning, research training and development will be sustained through regional centre of leadership. The centre would develop project exit plans that would focus on training of researchers and trainers and deploying them in the various areas of the research projects, strengthen processes such as the seed unit that supports the production of early generation seeds.

Resource mobilization especially that goes beyond providing government funding and outside including the private public partnerships, a technical committee will be established to prepare and approve proposals so that any funding opportunities are not missed. There shall also be efforts to provide research services on a cost recovery basis especially through our laboratories, so that such laboratories become income generating. Finally, policy advocacy and lobbying to gain support to sourcing some of the projected results or gains shall continue in Zambia.

## 12 Board chairs' closing remarks

(M.E. Mogajane)

In the instruction speech, it was important to ask members this question. What can be done going forward?

Given the good work that scientist had produced over the time, there was emphasis to encourage linking of all research output to the SADC protocol on trade and development so that such would promote trade in agriculture within the region. There was a necessity for pay more attention and focus on the farmicides as farmers should be trained to practice well as a requirement in interstate to eliminate trade barriers.

Member states were encouraged to improve the extensional services as well as advisory services to farmers so as to enhance their skills in the adoption of technology pest control and harvesting.

There is need to pay extra care and attention to information sharing and knowledge dissemination especially after all this research is stored.

Strong emphasis also was made to delegates to encourage efforts to attract investments in agriculture in the region especially in agriculture.

Messages to new states such as Lesotho and Angola were that they should exploit what other countries have achieved through sharing and tapping at institutional memory by exploiting this trend within the regional networks.

There was also mention of the fact that South Africa was equally poor and food insecurity is a reality and should not be excluded in these initiatives. Therefore, SADC member states should be encouraged to join and participate in many of these programmes on an ongoing basis.

It was however recognised that scientists are paid very poorly, and the incentives are extremely low. Therefore, there should be some dedicated the efforts by various bodies to enhance and improve the incentives of scientists.

Lastly, participants were encouraged not to forget enhancing women representation in agriculture more so at the policy level.

## 13 Key Takeaways

- In order to increase accessibility, availability, of technologies it is necessary that respective countries find avenues to continue with activities of the programmes.
- All countries agree to the need to find alternative funding to follow up with activities.
- There should be continued dissemination of technologies developed and make them available to farmers in the respective countries.
- Respective countries are encouraged to link farmers to markets so as to enhance improved livelihoods among small holder farmers.
- There is need to continue work on resilience to heat, drought and low soil fertility breeds in the wake of climate change especially of those that are resilient to biotic and abiotic stresses.
- In all countries, there should be strengthening of pre-basic and basic seed production in order to address issues of basic seed demand.
- Countries should ensure release of technologies under Pre-release/pipeline.
- Noted the need for strengthening of procurement and financial management system.
- Products developed & deployed will require government efforts alongside dietary diversification, fortification and capsule immunization to mitigate micronutrient deficiencies.
- Need to increase awareness about the importance of nutritious maize varieties to the public among all countries.
- Selected lines in the participating countries should be multiplied and channelled for release as commercial varieties.
- Leverage on existing Conservation Agriculture (CA) field activities in order to get desired results.
- Set-up well-established and sustainable seed production units.
- Model development predicting insect and disease outbreaks.

## 14 Annexes

### 14.1 The CCARDESA Tag line development and launch of Mobile Learning App

There had been previous discussion around the possible tag line. However, delegates had been requested to kindly choose 5 taglines of their preference and rank them in order of priority from 1 to 5. One (1) present first choice of the five taglines.

Table 2: Temperate for voting for preferred taglines

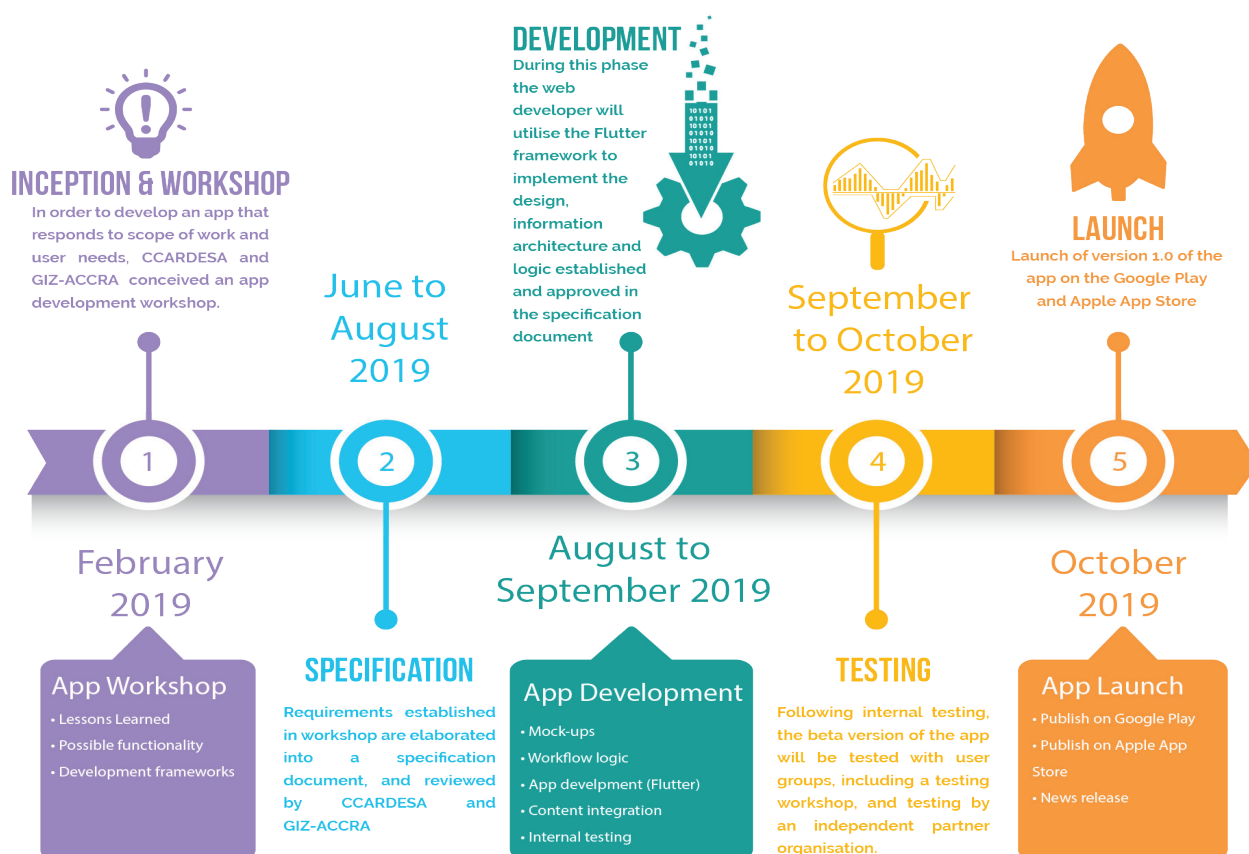
	Suggested tag lines	Tick your first 5 preferred Taglines	1-5, Rank them in order of priority
1	Innovativeness and resilience		
2	Knowledge hub		
3	Innovation for all		
4	Solution for every challenge		
5	Where imagination meets practice		
6	Resilience in agriculture and food systems		
7	Connect and grow		
8	Science for Development		
9	Technically perfect		
10	Research for better livelihoods		
11	Bring it on		
12	Towards innovative agriculture		
13	Engineering food and nutrition security		
14	Infinite genius possibilities		
15	Innovativeness and resilience		
16	Cracking agricultural challenges		
17	CCARDESA, an eye opener		
18	One Africa one solution		
19	Towards agriculture excellence		
20	Coordinating for prosperity		
21	Towards agricultural productivity		

CCARDESA mobile application were the main objective of the APP where;

- Off-line access to tools and resources
- Technical Briefs
- Learning
- Expand reach to extension officers
- Connect stakeholders

Below is the summary of the road map towards the development of the mobile app that can be downloaded from the google app store for free.





**Figure 1:** summary of the road map towards the development of the mobile application that can be downloaded from the google app store for free.

## 14.2 Display of key outputs from the APPSA RCoLs

Display booths were provided at the Conference to show case the key outputs of the APPSA R&D work. These included information on the range of varieties that have been released, technical leaflets on several different technologies for improved management as well as samples of processing and products of the value addition interventions. Below are two images from the display booths.



Display of key outputs from the APPSA RCoL



Display of key outputs from the APPSA RCoL

### 14.3 Concluding submissions from the APPSA 1 Countries- Malawi

- RCoLs have been established and strengthened (Training, infrastructure, equipment)
- Use of modern technology to communicate amongst participating countries on emerging issues which will enhance productivity in agriculture and economic growth of the people
- Collaborative publication on key typical issues currently researched in APPSA will continue
- Networks developed will enhance lobbying of resources for research i.e. cross-country multidisciplinary teams can easily be formed
- Deliberate effort of governments to put funds in the budget for sustaining gains of APPSA eg purchase of lab equipment, regional integration
- Engaging private sector in service delivery system using PPP- evidence from APPSA research

Domestication of regional Policies e.g. fasten processes of regional Seed Policy harmonization and other agendas

### 14.4 Concluding remarks from the APPSA 1 Countries: Mozambique

#### Challenges and Perspectives of Mozambique - APPSA I

##### A. Challenges

1. Mobilization of resources to continue technology generation and dissemination activities
2. Create staff positions at IIAM for the Regional Center of Leadership (RCoL).
3. Recruit, relocate and train RCoL research and support staff (we note that recruitment is already underway at IIAM. Therefore, some of these new staff will be redirected to RCoL and will be on government payroll).
4. Participation of regional and international support in RCoL (such as CGIARs and other partners and stakeholders)
5. Build and strengthen link with private sectors in the rice value chain (Public-Private Partnership)
6. Outsourcing and licensing through capitalization and collaboration with other initiatives such as AGRA, SEMEAR and others.

## B. Perspectives

1. Design actions with the involvement of all actors aimed at the dissemination and massification of technologies developed to produce concrete changes in the lives of producers, resulting from the adoption of technologies
2. Treat commodities (such as rice) throughout as value chain, with a greater focus on the market, as a driving force for production and adoption.
3. Develop actions to increase the levels of technology uptake by family producers.
4. Private Sector Engagement.
5. Expectation to comply with the Malabo Declaration, NEPAD and other regional agreements allocating 10% of GDP to Agriculture. The government.
6. Approval of the 2nd phase of APPSA to help materialize some of the above points.

### 14.5 Concluding Remarks from the APPSA 1 Countries: Zambia

#### SUSTAINABILITY STRATEGY FOR THE FOOD LEGUME BASED FARMING SYSTEM REGIONAL CENTRE OF LEADERSHIP BEYOND 2020

##### BACKGROUND

APPSA has in the last six (6) years enabled Zambia achieve **enhanced institutional capacity development** through **strategic investment in research infrastructure** (e.g. rehabilitation of irrigation facilities; rehabilitation and equipping of laboratories and establishment of seed unit) and **human capital development** through training of staff in **critical thematic areas**. In addition, a number of crop varieties have been released and promoted. Institutional capacity that has been created is critical for the sustenance and strengthening of the RCoL for Food Legume based Farming System.

##### SUSTAINANCE OF APPSA ACHIEVEMENTS BEYOND 2020

In order to sustain the efforts made under APPSA, ZARI's sustainability strategy for the RCoL is anchored on the following pillars:

- (i) Strategically deployment of trained staff

Leverage on the human resources capacity (both scientists and management) that has been trained under APPSA in trying to come up with a re-deployment plan

- (ii) Strengthening the established seed unit

Strengthen the Seed Unit by putting in place coordination mechanisms to run the seed unit to be fully functional

Come up with a strategy to be able to be visible in the region as RCOL for legumes

(iii) Strengthen strategy for Resource mobilization

Strengthen the operations of the technical committee that is in charge of approving proposals at institutional level

(iv) Provision of research services on cost recovery basis

This will entail getting authority through Government treasury by coming up with a proposal for cost recovery arising from provision of research and advisory services. This will also entail reposition ZARI through:

- Accreditation of some of the labs by leveraging on the refurbishments that have taken place through APPSA
- Operationalize the sustainability plan for all labs within ZARI as well as the Soil testing mobile lab

(v) Operationalization of institutional instruments such as Strategic Action Plan and Intellectual Property Policy

Operationalization of institutional instruments will entail:

- Conducting targeted research that could attract funding from the private sector. This will also enhance creation of strategic partnerships.
- Leverage and strengthen the research-extension linkages that have been established under APPSA

(vi) Secure support from policy makers

Packaging key results of APPSA as a selling point targeting buy in by policy makers through:

- Development of more policy briefs which could be linked to national policies and development plans.

Engage with the Parliamentary Committee on Agriculture, Environment and Natural Resources and through Policy and Planning Department under the Ministry of Agriculture on how the gains from APPSA can better be sustained. These issues can then be tabled before parliament.

## 14.6 Program of events for the End of Project Conference



**CCARDESA**  
Centre for Coordination of Agricultural Research and Development for Southern Africa



**THE WORLD BANK**  
IBRD · IDA | THE WORLD BANK GROUP

**AGRICULTURAL PRODUCTIVITY PROGRAMME FOR SOUTHERN AFRICAN (APPSA)**

**END OF PROJECT CONFERENCE**

**HOLIDAY INN JOHANNESBURG AIRPORT HOTEL, SOUTH AFRICA**

**27 November – 29 November 2019**

**THEME: Regional collaboration provides a platform for faster development & dissemination of technologies under APPSA**

## AGENDA

<b>CONFERENCE FACILITATOR – Mr Felix Banda</b>		
DAY 1: 27th Nov. 2019		
<b>Time</b>	<b>Title</b>	<b>Presenter/Institution</b>
08:20 – 08:50	Registration of the participants	Conference Secretariat
<b>OPENING SESSION</b>		
09:00 – 09:10	General Introductions	Facilitator
09:10 – 09:15	Welcome remarks	CCARDESA
09:15-09:30	Remarks	PS Malawi PS Mozambique PS Zambia
09:30 – 09:40	Remarks	World Bank
09:40 – 09:50	Opening remarks	Board Chairperson
<b>09:50 – 10:30</b>	<b>HEALTH BREAK (incl. group photo)</b>	
<b>Session 1: RCoL PRESENTATIONS</b>		
<b>10:30 – 10:55</b>	<b>Presentation: APPSA Overview</b>	<b>CCARDESA</b>
11:55 – 11:20	R&D Efforts under MAIZE	Kesbell Kaonga
11:20 – 11:45	R&D Efforts under LEGUMES	Kennedy Muimui
11:45 – 12:05	R&D Efforts under RICE	Paulino Munisse
12:05 – 12:30	R&D Efforts under Cassava	Jamisse Amisse
<b>12:30 – 12:50</b>	<b>Plenary</b>	
<b>12:50 – 14:00</b>	<b>LUNCH</b>	
<b>Session 2: MONITORING, EVALUATION, LEARNING AND COMMUNICATION</b>		
14:00 – 14:25	<b>Keynote address:</b> Role of Monitoring, Evaluation and Learning of R&D projects	Stephen Tembo
14:25 -14:50	<b>Keynote address:</b> Knowledge Management and communication in R&D projects	Dr Gracian Chimwaza
<b>14:50 – 15:05</b>	<b>Plenary</b>	
<b>15:05 – 15:20</b>	<b>HEALTH BREAK</b>	
<b>Session 3: CROP IMPROVEMENT</b>		
<b>15:20 – 15:45</b>	<b>Keynote Presentation on crop improvement</b>	John Musanya
15:45 – 16:00	Improving Nutritional quality in maize in Malawi, Mozambique and Zambia	Kabamba Mwansa
16:00 – 16:15	Establishment of Core Collection of Reference Varieties and Drought Tolerant Threshold for Maize in Mozambique, Malawi and Zambia	Constantino Senete
16:15 – 16:30	<b>Plenary</b>	
<b>Session 4: DEVELOPMENT OF CCARDESA TAGLINE</b>		<b>CCARDESA</b>
<b>16:30 – 17:30</b>	<b>Development of CCARDESA Tagline</b>	<b>CCARDESA</b>
<b>18:00 – 20:00</b>	<b>Launch of CCARDESA Communications app and cocktail</b>	<b>CCARDESA</b>
<b>END OF DAY 1</b>		

<b>DAY 2: 28<sup>th</sup> Nov. 2019</b>		
<b>Session 5: CROP IMPROVEMENT</b>		
08:00 – 08:05	House Keeping/Announcements	CCARDESA
08:05 – 08:20	Breeding Improved maize	Kesbell Kaonga
08:20 – 08:35	Development of high Iron and Zinc beans with resistant to Angular leaf spot and Common bacterial blight in Zambia, Malawi and Mozambique)	Kennedy Muimui
08:35 – 08:50	Use of root traits in screening common bean genotypes tolerant to drought in Mozambique, Malawi and Zambia	Manuel Amane/Virginia Chisale
08:50 – 09:05	Development and Promotion of Improved Pigeon Pea Varieties for Increased and Sustainable Production)	Kennedy Kanenga
09:05 – 09:20	<b>Plenary</b>	
09:20 – 09:35	Adoption of released pigeon pea (cajanus cajan (L.) Millisp.) Varieties in Nampula and Zambézia Provinces	Salva Somueque
09:35 – 09:50	Breeding Groundnut Varieties for Multiple Disease Resistance for Market access in Malawi, Mozambique and Zambia	Lutangu Makweti
09:50 – 10:05	Development of Improved Rice varieties in Zambia	Chitambi Musika
10:05 – 10:20	Performance of Mucelo, CXT30 and IR50404 improved rice varieties under lowland ecologies in the North and Central Mozambique	Hermínio Abade:
<b>10:20 – 10:40</b>	<b>Plenary</b>	
10:40 – 11:00	<b>HEALTH BREAK</b>	
<b>Session 5: INTEGRATED PESTS AND DISEASE MANAGEMENT</b>		
<b>11:00 – 11:25</b>	<b>Keynote Presentation on Integrated pests and disease management</b>	<b>Dr Joyce Muli-la-Mitti</b>
11:25 – 11:40	Breeding Striga tolerant Maize	C.D. Mwale
11:40 – 11:55	Determining the occurrence of cassava brown streak disease in Zambia	Rabson Mulenga
11:55 – 12:10	Breeding for Maize Leaf Necrosis Disease tolerance	Jonny Masangwa
12:10 – 12:25	Evaluation of Zero Fly® Storage Bag for the Control of Insect Storage Pests in Maize Grains in Zambia	Gilson Chipabika
<b>12:25 – 12:45</b>	<b>Plenary</b>	
12:45 – 14:00:	<b>LUNCH BREAK</b>	
<b>Session 7: MECHANIZATION, POST-HARVEST &amp; VALUE CHAIN</b>		
<b>14:00 – 14:25</b>	<b>Keynote address on post-harvest processing and value addition</b>	<b>Prof. Brighton Mvumi</b>
<b>14:25 – 14:40</b>	Rice processing and nutrition through supplement of rice sub products to rural women and orphans	Agnes Mwangwela
<b>14:15 – 14:35</b>	Improving Grain Storage Structures for Smallholder Farmers in Zambia)	Nswana Kamfwafwa
<b>14:35 – 15:00</b>	<b>Keynote address on Technology mechanization</b>	
<b>15:00 - 15:20</b>	<b>General discussion</b>	
<b>15:20 - 15:40</b>	<b>HEALTH BREAK</b>	
<b>Session 6: CLIMATE SMART AGRICULTURE: CONSERVATION AGRICULTURE</b>		
<b>15:40 – 16:05</b>	<b>Keynote address on Climate smart agriculture</b>	<b>Sina Luchen</b>



16:05 – 16:20	Disease and Pest Challenges in Maize Production under Conservation Agricultural Cropping Systems: What Do We Learn?	Mathias Tembo
16:20 – 16:35	Improving Water Efficiency in Maize Production	Alfredo Nhantumbo
16:35 – 16:50	Plenary	
<b>17:00</b>	<b>END OF DAY 2</b>	

<b>DAY 3: 29th Nov. 2019</b>		
<b>Session 7: SOCIAL ECONOMIC STUDIES Moderator:</b>		
08:00 – 08:15	Agro dealer study	Fredrick Choma
08:15 – 08:30	Adoption study	Crispin Kapunda
08:30 – 08:45	Cost-Benefits analysis	Joao Mudema
08:45 – 09:00	Mapping dissemination pathways of Maize, Bean and Rice	Ken Machira
09:00 – 09:15	Plenary	
<b>Session 7: TECHNOLOGY DISSEMINATION AND SEED SYSTEMS Moderator:</b>		
<b>09:15 – 09:40</b>	<b>Keynote address on Technology Dissemination and dissemination pathways</b>	<b>Dr Kalawole Odu-bote</b>
09:40 – 09:55	Enhanced dissemination of improved technologies for increased production	Katumwa Mutandi
09:55 – 10:10	Field Performance, Evaluation and Dissemination of Small Tractors in CA in Central Mozambique And Malawi	José Domingos Dias
10:10 – 10:25	Strengthening Legume seed delivery systems in Mozambique- The role of promotional campaigns on technology dissemination and adoption	Magalhães Miguel
<b>10:25 – 10:40</b>	<b>Plenary</b>	
10:40 – 11:00	<b>HEALTH BREAK</b>	
11:00 – 11:15	Dissemination pathways	Henry Msatilomo
11:15 – 11:30	Enhanced dissemination of Food legumes-based technologies for increased production	Belarmino Divaz:
11:30 – 11:45	Improving rice processing and nutrition through supplementation of rice sub products to rural woman and orphan children in Mozambique	Cheila Chiconela:
11:45 – 12:00	Presentation of dissemination material	Godfrey Liwewe
<b>12:00 – 12:30</b>	<b>Plenary</b>	
<b>12:30 – 13:30</b>	<b>LUNCH</b>	
<b>Session 9: WAYFORWARD/GENERAL DISCUSSION: Moderator:</b>		
13:30 – 13:50	Lessons learning and way forward	Moses Musikanga
13:50 – 15:00	<b>CLOSING SESSION</b>	
	Remarks: Representative of the Invited Countries	Invited Countries
	Remarks: Representative of the current APPSA implementing Countries	Current Countries
	Remarks: World Bank Representative	World Bank
	Closing remarks	Board Chairperson
<b>15:00</b>	<b>END OF CONFERENCE</b>	



**Center for Coordination of Agricultural research and Development for  
Southern Africa (CCARDESA) Plot 4701 Station Exit Road, Private Bag  
00357, Gaborone, Botswana  
Tel: +267 391 4991/7**

**Visit the CCARDESA Southern African Agricultural Information and  
knowledge Systems (SAAIKS)  
Link: <http://www.ccardesa.org/saaiks>**