Annual Report

Project Sustainable Intensification of Maize-Legume based Cropping Systems for Food Security in Eastern and Southern Africa (SIMLESA)

Project no. CSE/2009/024

Period of report July 2013–June 2014

Date due 31 July 2013

Date submitted 31 Jul 2013

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- Association for Strengthening Agriculture Research in Eastern and Central Africa
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SIMLESA target and spillover countries

*Zambia is currently benefiting from a US-AID SIMLESA related program, Sustainable Intensification of Maize-Legume Systems for the Eastern Province of Zambia (SIMLEZA)*

**Acronyms**

ACIAR | Australian Center for International Agriculture Research
AGRA  Alliance for a Green Revolution for Africa
AGRIMERC  Organisation for Sustainable Development of Agriculture and Rural Markets
AIFSC  Australian International Centre for Food Security
APSIM  Agricultural Production Systems Simulator
APSFarm  Agriculture Production Systems Simulation Model for the Whole Farm System
ARARI  Amhara Regional Agricultural Research Institute
ARC  Agricultural Research Council, South Africa
ASARECA  Association for Strengthening Agricultural Research in Eastern and Central Africa
ASSMAG  Association of Smallholder Seed Multiplication Action Group
BARC  Bako Agricultural Research Center
BMGF  Bill & Melinda Gates Foundation
BNF  Biological nitrogen fixation
BOM  Opportunity Bank of Mozambique
CA  Conservation agriculture
CIMMYT  International Maize and Wheat Improvement Center
CIRAD  Agricultural Research for Development, France
CORAF  Conference of the Agricultural Research Leaders in West and Central Africa
CRS  Center for Rhizobia Studies (Murdoch University)
CSIRO  Commonwealth Scientific and Industrial Research Organization
DALDO  District Agricultural and Livestock Development Officer
DEEDI  Department of Employment, Economic Development and Innovation, Queensland
DTMA  Drought Tolerant Maize for Africa Project
EGSP  Effective Grain Storage for Better Livelihood of African Farmers Project
EIAR  Ethiopian Institute of Agricultural Research
EPA  Extension planning area
FARA  Forum for Agricultural Research in Africa
HARC  Hawassa Agricultural Research Center
IAC  Chimoio Agriculture Centre
IARCIARC  International Agricultural Research Center
IAV  Crops and Veterinary Inputs
ICARDA  International Center for Agricultural Research in the Dry Areas
ICIPE  International Center of Insect Physiology and Ecology
ICRISAT  International Crops Research Institute for the Semi-Arid Tropics
IDEAA-CA  Associação dos Produtores de Oleaginosas (Oil crops association ex-Initiative for development of Agriculture in Africa)
IFAD  International Fund for Agricultural Development
IFDC  International Fertilizer Development Cooperation
IFPRI  International Food Policy Research Institute
IIAM  Mozambique’s Agricultural Research Institute
IMAS  Improved Maize for African Soils Project
IITA  International Institute of Tropical Agriculture
ILRI  International Livestock Research Institute
IRRI  International Rice Research Institute
ISPM  Polytechnic Institute of Manica
KARI  Kenya Agricultural Research Institute
LER  Land equivalent ratio
MARc  Melkassa Agricultural Research Center
MASA  Malawi Seed Alliance
M&E  Monitoring and evaluation
NARES  National Agricultural Research and Extension System
NARI  National Agricultural Research Institute
NARS  National Agricultural Research Systems
NEPAD  New Partnership for Africa's Development
NGO  Non-Governmental Organization
OPV  Open pollinated variety
PARC  Pawe Agricultural Research Center
PASS  Program for Africa’s Seed Systems
PVS  Participatory variety selection
QAAFI  Queensland Alliance for Agriculture and Food Innovation
SIMLESA  Sustainable Intensification of Maize and Legume Cropping Systems for Food Security in Eastern and Southern Africa Program
SPER  Provincial extension services
TLC  Total Land Care
TLII, TL-2  Tropical Legumes II Project
UCAMA  Manica Small-scale Farmers Association
WECARD  West and Central African Council for Agriculture Research Department
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1 Progress summary

The Sustainable Intensification of Maize-Legume cropping systems for food security in Eastern and Southern Africa (SIMLESA) is a multi-stakeholder collaborative research programme managed by the International Maize and Wheat Improvement Centre (CIMMYT) and implemented by national agricultural research systems (NARS) in Kenya, Tanzania, Ethiopia, Malawi and Mozambique with backstopping inputs from other partners. The programme focuses on leveraging science and technology to develop and deliver technological and institutional innovations in relation to maize-legume production systems. In turn it is envisaged that these will make significant measurable positive changes in the livelihoods of all categories of smallholder farmers.

The aim of SIMLESA program is to improve farm-level food security, in the context of climate risk and change, through the development of more resilient, profitable and sustainable farming system that overcome food insecurity for significant numbers of farm families in eastern and southern Africa. SIMLESA Program, is being funded by the Australian Centre for International Agriculture Research (ACIAR) launched in March 2010 and expanded in April 2012 (with funding support from AusAID) to cater for three additional regions in Ethiopia.

SIMLESA Program falls under the African Food Security Initiative (AFSI) that was launched in 2009/2010 by the Australian Government to assist selected African countries reduce poverty and eliminate hunger as part of fulfillment of Millennium Development Goal Number 1 (MDG1). It is aligned within the African Union (AU) initiative and led made-in-Africa solution known as the Comprehensive Africa Agriculture Development Program (CAADP\textsuperscript{*}). CAADP was established as part of the New Partnership for Africa's Development (NEPAD), and endorsed by the African Union Assembly in July 2003.

SIMLESA is led and managed by the International Maize and Wheat Improvement Centre (CIMMYT), as the commissioned organisation. CIMMYT is assisted by the following in implementing the program: the national agricultural research systems (NARS) in five eastern and southern African countries; Association for Strengthening Agricultural Research in Eastern and Central Africa (ASARECA), International Crops Research Institute for the Semi-Arid Tropics (ICRISAT); Agriculture Research Council (ARC)-SA; Queensland Alliance for Agriculture and Food Innovation (QAAFI), in association with Queensland Department of Employment, Economic Development and Innovation, (QDEEDI); and Murdoch University.

SIMLESA related activities have been initiated in four spillover countries (Botswana, Rwanda, South Sudan and Uganda) for wider impact. The leadership of the Queensland research component has been transferred from DEEDI to QAAFI. The main thrust of the SIMLESA program is increasing farm-level food security, productivity and incomes through promotion of maize-legume intercropping systems, in the context of reduced climate risk and change. SIMLESA Program is envisaged to reach 650,000 small farming households in the five countries over a period of 10 years.

Monitoring and evaluation of the planned activities were coordinated by ASARECA. In performing this function, ASARECA provided the leading role in the development of the broad Monitoring and

\textsuperscript{*} CAADP pillars number 3 and 4- increasing food supply and reducing hunger across the region by increasing smallholder productivity and improving responses to food emergencies; and improving agricultural research and systems to disseminate appropriate new technologies, and increasing the support given to help farmers to adopt them.
evaluation (M&E) framework for the project; it also participated in training of partners to facilitate evidence-based and adaptive management. Together with partners involved, it applied its broad M&E framework, which is in line with the Comprehensive Africa Agricultural Development Program (CAADP) framework that is adopted by many of the Africa Union (AU) member states, to facilitate monitoring and evaluation of SIMLESA. The program implementers along with field-based teams played a major role in data collection and reporting.

SIMLESA program is being implemented under the following five fundamental objectives:

**Objective 1:** To characterize maize-legume production and input and output value chain systems and impact pathways, and identify broad systemic constraints and options for field testing.

**Objective 2:** To test and develop productive, resilient and sustainable smallholder maize-legume cropping systems and innovation systems for local scaling out

**Objective 3:** To test and develop productive, resilient and sustainable smallholder maize-legume cropping systems and innovation systems for local scaling out

**Objective 4:** To support the development of regional and local innovations systems

**Objective 5:** Capacity building to increase the efficiency of agricultural research today and in the future

The initial phase of SIMLESA which started in 2010 ended on the 31st of June 2014 which was surpassed by SIMLESA 2. Its background is mainly based on four main rudiments; SIMLESA-1 collective experience, 3rd Annual Review and Planning Meeting (ARPM), Mid-term Review (MTR) and Project Steering Committee (PSC).

The overall objective of the second phase of SIMLESA is a continuation of the original 10-year vision by the year 2023:

- to sustainably improve maize & legume productivity of selected maize-based farming systems in each target country by 30% from the 2009 average
- to reduce the expected downside yield risk by 30%
- on approximately an additional 650,000 farms

**SIMLESA 2 Objectives**

1. to enhance the understanding of CA-based sustainable intensification for maize-legume production systems, value chains and impact pathways;

2. to test and adapt productive, resilient and scalable CA-based intensification options for sustainable smallholder maize-legume production systems;

3. to increase the range of maize, legume and fodder/forage varieties available to smallholder farmers;

4. to support and develop local and regional innovation systems and scaling-out modalities;

5. capacity building to increase the efficiency of agricultural research today and in the future
This report presents some of the key achievement made in the previous annual reporting period, July 2013 to June 2014. It illustrates the key results per objective, as well as aggregation of contribution from the five SIMLESA implementing countries, that is Ethiopia, Kenya, Tanzania, Malawi and Mozambique.

The main activities carried out are surveys (adoption monitoring, market, partial analysis, completion of baseline and topology analysis) and marketing trainings. QAAFI continue with the preparation of journal articles for publication on households’ typology across five SIMLESA countries of operation. Objective 1 achievements and scaling out plans were discussed at Annual Review Planning Meetings (ARPM) which were held between October and December 2013 in respective countries. Mozambique and Malawi meetings were combined as a cost cutting measure as well as enhancement of partner to partner collaboration and information sharing.

The period July 2013 to June 2014, has been mainly devoted to establishment of trials, technology analysis and implementation of identified scalable technologies under objective 2 of SIMLESA program. Activities carried out during this period include proper planning for effective scaling out of SIMLESA technologies to many farmers in all 5 core countries. Selection of scalable technology was conducted based on statistical results and target farmer’s preference using participatory methodologies. Minimum tillage-maize-legume intercropping was identified as best-bet technology by farmers in most regions. Exchange visit, field days, trial evaluation, IP meeting and farmer training were conducted in all SIMLESA countries during the reporting period.

Main activities carried out under objective 3 in the reporting period include PVS, seed increase, varietal characterization (distinctness, uniformity and stability (DUS), performance and yield potential), GXEXM analysis and testcross formations. The activities were complemented by efficacy of trial management, data collection, PVS evaluation and field days. During the reporting period scalable technologies including new seed varieties were identified and scaling out plans for the next production season were developed during ARPM country specific meetings. Scientists, seed companies, stockiest and farmers under objective three of the program continued with formal and informal evaluation and promotion of community endorsed maize and legumes new seed varieties.

Capacity building trainings and support of students (PhD and Msc students) in data collection were the main activities under objective 4 and 5. Gender Mainstreaming Unit (GMU) of the Association for Strengthening Agricultural Research in East and Central Africa (ASARECA), contributed to SIMLESA project activities by providing technical backstopping in gender mainstreaming. The overall objective is to ensure the consideration of gender aspect in the different activities of SIMLESA.
2 Achievements

2.1 Achievements against project activities and outputs/milestones: July 2012 – June 2013

This report is an outcome of activities conducted between July 2013 and June 2014 in eastern and southern Africa under SIMLESA Program. The first objective of the program is to characterize maize-legume production and input and output value chain systems and impact pathways, and identify broad systemic constraints and options for field testing. Under the reporting period various surveys were conducted which include surveys, typology, value chain, adoption monitoring and community surveys. Program achievements are presented objective by objective from 1 up to 5.

Objective 1: To characterize maize-legume production and input and output value chain systems and impact pathways, and identify broad systemic constraints and options for field testing

The achievements of milestones towards objective 1 are summarized in table 1.1 below. For each objective, the achievements of each partner are presented in the following sub-sections.

Table 1.1 Objective 1 Summary of milestones according to the log frame and project work plan

<table>
<thead>
<tr>
<th>Output</th>
<th>Milestone</th>
<th>Date due for implementation</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.1: Initial characterization of 10 maize-legume farming systems and selection of 30 research sites/communities</td>
<td>1.1.2: Indicative opportunities for agribusiness and market development in maize-legume systems identified</td>
<td>August 2010</td>
<td>Fully achieved in all countries</td>
</tr>
<tr>
<td>1.3: Understanding maize and legume input and output markets and value chains including chain constraints and opportunities, costs and pricing patterns associated with the ten farming systems.</td>
<td>1.3.1: Instruments, tools and protocols for survey data collection standardized for all participating countries</td>
<td>June 2011</td>
<td>Fully achieved in all countries</td>
</tr>
<tr>
<td></td>
<td>1.3.2: Output market chain data and maps (maize, legumes, crop residues-including market shares, costs, price variability, role of grain quality) developed for selected markets/countries</td>
<td>March 2012</td>
<td>Market chain data available for all countries</td>
</tr>
<tr>
<td>1.4 Several farm-household system options identified which are risk reducing and productivity enhancing for each other of the ten farming systems for testing in the research sites/communities</td>
<td>1.4.1 Farm household typology developed and case studies identified based on household survey data (link to 1,2)</td>
<td>May 2013</td>
<td>Done for all the countries</td>
</tr>
</tbody>
</table>
1.5 Effective adoption and impact pathways assessed for 10 maize-legume systems

1.5.1 Evaluation criteria, indicators and monitoring processes selected by the team.

Year 1-4

Done for all the countries

Ethiopia

SIMLESA team in Ethiopia under objective one conducted immense program activities which includes adoption monitoring, market survey, baseline survey, topology analysis and marketing training during the reporting period.

Survey instruments for program adoption monitoring surveys were developed and circulated to national team coordinators in all of the Ethiopian SIMLESA sites. In this regard, identification of SIMLESA technology users is underway in most operational districts. This entails statistics analysis of the SIMLESA technology uptake.

Market survey was completed for maize-legume input and output urban consumers and market participants. Data entry and subsequent activities are underway; this is being spearheaded by CIMMYT, Ethiopia. Typology analysis is going on in collaboration with QAAFI. Adoption monitoring survey was completed in all implementation sites and data analysis is in progress.

Kenya

Main activities which were executed in Kenya comprise of completion of baseline survey, market survey and technology adoption monitoring in both Eastern and Western regions.

The main achievement undertaken was maize/legume agribusiness/market (value chains aspects and adoption) opportunity and technology adoption studies of CA practices and varieties in the 4 project sites, in collaboration with partners. Baseline surveys were completed and reports prepared. In addition farm household typologies were conducted and a manuscript was prepared for submission to global food security refereed journal. A total of 285 households were interviewed for determination of the project impact. Data is currently being entered with the hope of sharing results with key stakeholders.

Tanzania

Activities under objective one in Tanzania were implemented as planned during the reporting period, these activities include:

i) Early, mid and end of season (after harvest) evaluation of farming technologies, Conservation Agriculture (CA), Currently Agronomic Practice (CAP) and alongside with farmer practice (FP) were conducted in the last half of 2013. Evaluation results indicated that farmers preferred CAP technology mainly due to increased yield, reduce production risk and improve food security. However, they mentioned some negative aspects of CAP associated with high land preparation and weeding costs. The results revealed that beside CAP, farmers preferred CA because of increase yield, reduce production risk and decrease cost of weeding, conserve soil and water, less expensive and improve soil fertility. Contrary to benefits of CA farmers expressed the negatives of CA as high cost of herbicide and equipment (Sprayer). FP was lowly rated due to low production and high labour cost.
ii) Evaluation of maize and pigeon pea in Participatory Variety Selection (PVS) trials was conducted in operational districts of Tanzania. Ten and twelve maize varieties were in the PVS in the northern and eastern zone, respectively. In addition, seven and six pigeon pea varieties were in the PVS in the northern and eastern zone respectively. Farmers selected Selian H 308 and TZM 523 maize varieties in the northern and eastern zone, respectively. The preferred trait across the maize varieties were large grain size, pest tolerant, disease tolerant, good storability, drought tolerant and high grain yield. Overall, pigeon pea varieties, namely, ICEAP 00040, ICEAP 00932 and ICEAP 00068 scored high across communities in the northern and eastern zone. The most preferred characteristics of pigeon peas varieties by farmers were: i) drought tolerant, ii) grain yield iii) early maturity iv) pest and disease tolerant and v) marketability.

iii) A farmer training on partial budgeting was done during the reporting period. A total of 34 farmers (25 Male and 9 female) from Mbulu and Karatu districts (northern zone) were trained. A similar training was attended by 37 participants (25 Male and 12 female) from Gairo, Kilosa and Mvomero districts (eastern zone)

iv) Monitoring survey of adoption and impact pathways was done in October-November 2013 to monitor adoption of management technologies especially CA. In the eastern zone, 1279 and 31 farmers adopted CAP and CA, respectively. Overall, a total of 1310 households adopted improved technologies in the eastern zone, (734 male and 576 female). A total of 3287 farmers (2088 males, 1199 females) have adopted SIMLESA technologies through different approaches including farmer field days, extension services, demonstration plots and partnerships. The most important reason given as a constraint for CA adoption is lack of herbicide at village level.

v) The University of Geneva collaborated with SIMLESA Objective 1 through CIMMYT. Under this collaborative research and partnerships a total of 700 farmers received 2kgs each of improved maize seed (Situka M1) mainly for comparison with farmer maize variety.

Malawi

In Malawi under objective 1, economic analysis of data from all CA trials was collected and analysis was done during the reporting period. Results indicated that CA dibble stick gave higher net benefits compared to conventional farming system. Inclusion of legumes under crop rotation system for example groundnuts and soybeans had very high benefits due to the higher selling prices of $0.80 and $0.50 per kg respectively of these commodities compared to the maize staple. In districts like Salima, dibble stick groundnuts in the plot with rotation yielded net benefits of as high as over $2000/ha which was nearly double with regards to the conventional maize plot that generated slightly over $900/ha.

Baseline report was finalized. Effective adoption and impact pathways were assessed through adoption surveys. Major farm household typologies and system options that reduce risks and enhance profitability were identified.

Mozambique

SIMLESA second round survey
After the baseline, SIMLESA carried out the second round data collection to evaluate the impact of the project. This activity was implemented in collaboration with a project that is coordinated by Eduardo Mondlane University called adoption pathways. During the reporting period, the following activities were conducted:

- Translation of the questionnaire into Portuguese was finalized; questionnaires were adjusted to suit Mozambican context and were pre-tested. A total of 20 enumerators (6 female and 14 male) were trained and 16 enumerators (4 female and 12 male) were engaged in data collection in 3 districts, namely: Sussundenga, Manica and Angónia. It was not possible to collect data in Gorongosa due to current political instability in that district.

**Trial assessments and partial budget analysis**

Farmers had the opportunity to evaluate different agronomic aspects (number of plants, weed control, height, uniformity and colour) at different stages of growth. They were allowed to give 1 to 10 points at each treatment during various stages of evaluation (early, mid and end of season). In addition, farmers had the opportunity of comparing 6 treatments, with a field next to the trial. The results were compared with partial budget analysis of trial data. Results of the analysis show that:

- **Manica**: At the early season evaluation, farmer’s check and legume-maize rotation had the lowest score of 7. But at the mid and end of season evaluations there were not differences between the treatments. Analysis of the evaluation of the field next to the trial show that this field got the lowest score in all the seasons evaluated (5, 6 and 4 respectively). When analyzing profitability, it was found that all the treatments were profitable except legume-maize rotation that had a net benefit of - US$60.43, which is consistent with farmer’s evaluation. The most profitable treatment was maize-legume rotation that had a net benefit of US$2,171.57.

- **Sussundenga**: Farmers check and the field next to trial had consistently lower scores in the 3 evaluation periods. Intercropping had lower score only for mid and ends of season evaluations. Profitability analysis shows that, all the treatments were profitable, with maize-legume intercropping (696.00US$) being the most profitable treatment and direct seeded maize being the least profitable (US$158). Direct seeded maize was outperformed by conventional that generated US$332 per hectare.

- **Rotanda**: Legume maize rotation and field next to the trial had consistently lower scores in the early (7), mid (5) and end (6) of season evaluations. Profitability analysis shows that, all the treatments were profitable, with legume-maize rotation being the most profitable treatment with a net benefit of US$931.00. Net benefits increased under this plot as beans are sold at higher prices compared to maize on the markets. Conventional lot fetched the lowest net benefits of $3 /ha followed by direct seeded maize that had US$21 /hectare as net benefits.

- **Gorongosa**: All treatments were profitable, with maize-legume intercropping (net benefit equal to 204.00US$) and legume-maize rotation (net benefit equal to US$202.00) being the most profitable treatments. The conventional treatment was the lowest in performance with US$16 net benefits being realized per hectare.

- **Angonia (Ciphole)**: All treatments were profitable, with farmer’s check and maize basins being the most profitable treatments, with a net benefit of US$446.00 and US$450.00, respectively.
- **Angonia (Cabango):** All the treatments were profitable except legume-maize rotation that had a net benefit of $288US$. The two most profitable treatments were the conventional and the direct seeded maize intercropped with beans that had benefits of $762 and $461 respectively.

**Queensland Alliance for Agriculture and Food Innovation (QAAFI) in association with Queensland Department of Employment, Economic Development and Innovation, (QDEEDI), Australia**

- Options for summer cropping intensification were re-evaluated prior in preparation for Phase II. An industry wide survey and workshop identified research priorities for sorghum, wheat and maize in Queensland (See QAAFI report attached).
- Progress has continued with the preparation of journal articles describing the diversity of households across the five SIMLESA (household typologies).
- Progress has continued improving modelling tools to simulate smallholder farms in collaboration with ILRI (Mark VanWijk and Mariana Rufino) and CSIRO (Mario Herrero). This collaboration resulted in the development of a generic household model by linking the APSFarm (Rodriguez et al., 2011) and LivSim (Ruffino et al., 2008). This software development will allow scientists to model livestock integration activities (i.e. cattle, goats and sheep) across all SIMLESA countries. These activities have already started in other countries like Kenya. In Kenya household modeling results using the APSFarm-LivSim indicate important differences in terms of benefits and trade-offs from alternative intensification pathways across the different household typologies. These results support the hypothesis for the need to better target interventions to local agro-ecological and socio-economic conditions.

**Objective 2: Develop productive, resilient and sustainable smallholder maize-legume cropping systems and innovation systems for local scaling out**

In the reporting period, main SIMLESA activities under objective 2 conducted includes Annual Review Planning Meetings for scaling out phase and SIMLESA 2 preparations, identification of scalable technologies, farmer trainings, field days and strengthening of local innovation platforms. The achievements of milestones towards objective 2 are summarized in table 2.1 below.
Table 2.1: Objective 2 summary of milestones according to the log frame and agreed work plan:

<table>
<thead>
<tr>
<th>Output</th>
<th>Milestone</th>
<th>Date due for implementation</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.1. Identified options for systems intensification and diversification, which reduce risk in the ten farming systems using systems modelling.</td>
<td>2.1.2: Potential systems, practices and risk management strategies identified for the sustainable increase of maize system productivity and legume options for system diversification</td>
<td>October 2010</td>
<td>Done and ongoing</td>
</tr>
<tr>
<td>2.2. Functioning local innovation systems developed in each of ten maize-legume farming systems to help overcome system limitations and enhance scaling out of technologies</td>
<td>2.2.1: Diverse set of potential innovation system members invited to participate in field visits and efforts to increase the productivity of maize-legume systems in each of the 10 agro-ecologies; and initial innovation systems formed in each agro-ecology</td>
<td>January 2011</td>
<td>Done and ongoing</td>
</tr>
<tr>
<td></td>
<td>2.2.2: At least one field visit with the innovation system members conducted during the crop season in each target maize-legume system and visiting at least half of the target communities; and post-harvest visit of the innovation system members to each target maize-legume system to discuss results, problems and limitations and measures to overcome them</td>
<td>Mid-crop season-approximately May 2010</td>
<td>Done and ongoing</td>
</tr>
<tr>
<td></td>
<td>2.2.4: Innovation system members working on solutions to observed problems and limitations in the local maize-legume systems</td>
<td>December 2011</td>
<td>Done and ongoing</td>
</tr>
<tr>
<td></td>
<td>2.2.5: Documentation of most effective innovation processes and reasons for their success</td>
<td>2011, 2012 &amp; 2013</td>
<td>Done and ongoing</td>
</tr>
<tr>
<td>2.3. Evaluated exploratory trials of current best options for maize/legume smallholder systems for different farm types in with 5-6 cooperating farmers in each of thirty research sites/communities</td>
<td>2.3.3: Basic soil, climate, land use, topography and cropping history data available for each of the exploratory trial sites</td>
<td>December 2012</td>
<td>Done but continuing</td>
</tr>
<tr>
<td></td>
<td>2.3.4 Exploratory trials established by farmers with program orientation and support</td>
<td>June 2013</td>
<td>Done but is ongoing</td>
</tr>
<tr>
<td></td>
<td>2.3.5: Data available on qualitative and quantitative evaluations of exploratory trials by farmers and other members of the local innovation platforms</td>
<td>August 2011 and annually after that</td>
<td>Done</td>
</tr>
<tr>
<td>2.4 Adjustments to the maize-legume systems tested in the exploratory trials and farmer</td>
<td>2.4.4: Precise data on crop productivity and water dynamics available for crop/soil simulation model validation</td>
<td>July 2011 and annually after that</td>
<td>Done and ongoing</td>
</tr>
</tbody>
</table>
The period July 2013 to June, 2014 has been mainly devoted to establishment of trials and implementation of identified scalable technologies. This includes proper planning for effective scaling out of SIMLESA technologies to many farmers. Selection of scalable technology was conducted based on statistical results and target farmer’s preference. Minimum tillage-maize-legume intercropping was identified as best-bet technology by farmers in most regions. In addition, posters, banners, and leaflets were prepared and distributed to farmers in operational regions. Exchange visit, field days, trial evaluation, IP meeting and farmer training were conducted at different Ethiopia SIMLESA target areas during this report period. Furthermore, a write-shop was arranged and responsible researchers have discussed on their manuscripts with each other and with CIMMYT Addis Ababa scientists. Therefore, at least five manuscripts were selected for submission, with minor modifications, to journal for publication. A three day workshop was held in November at Adama and all responsible stakeholders for objective-2 were invited to present the status of their work and plan for the coming season.

**Main SIMLESA Sites**

**i. Melkassa Area**

Soil and agronomic data collections at different stages of the crops were completed for a total of 19 on farm trials established in the target districts namely Boset, Dugda, Adami Tulu and Shala and on-station exploratory trials. Soil water reading and soil sampling were done after harvest. Further, access tubes were

<table>
<thead>
<tr>
<th>experiments developed with farm and soil quality, system productivity and disease, pest and weed dynamics quantified.</th>
<th>2.4.5 Data available on the effects of technology options on soil quality, BNF and system productivity and sustainability</th>
<th>July 2012 and annually after that</th>
<th>Done and ongoing</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.4.6: Improved understanding of eco-physical traits to improved maize adaptation to different environments and management practices</td>
<td>December 2011.</td>
<td>Done but ongoing</td>
<td></td>
</tr>
<tr>
<td>2.6 Lessons from active farmer experimentation with CA-oriented systems incorporated into on-farm research trials in each of the thirty research sites/communities.</td>
<td>2.6.1: Farmers installing or planning install maize-legume CA-based experiments on their own fields identified</td>
<td>December 2011 and annually thereafter</td>
<td>Done and ongoing</td>
</tr>
<tr>
<td>2.7 Farmer learning through annual facilitated visits of farmers and their local extension agents between the targeted communities in each of the five countries</td>
<td>2.7.2 Farmer-to-farmer networking for scaling out of knowledge and technological innovations. At least one farmer study will take place in each country in or before the 2011/2012 season and one community in each agro ecology in the subsequent season</td>
<td>Mar 2013</td>
<td>Done but ongoing</td>
</tr>
<tr>
<td>2.7.3 Data on new farmer experiments permitting an evaluation of the effectiveness of the farmer-to-farmer visits</td>
<td>May 2013</td>
<td>Done but ongoing</td>
<td></td>
</tr>
</tbody>
</table>
installed to measure the moisture status of the CA and CP plots after harvest, and to determine water balance starting from end of season and throughout the dry period until the next planting.

During the reporting period numerous scaling out activities were conducted in Ethiopia which include on farm demonstrations, field days, exchange visits, training of partners and extension material development. Over 2000 leaflets were prepared in Amharic and Afan Oromo languages and distributed to farmers and partners during the reporting period.

In 2014, maize varieties, forage and CA based common bean rotation and intercropping have been established by 422 farmers (127 female and 295 male) in eight districts in the Central Rift Valley of Ethiopia. However, the crop has faced sever moisture stress due to prolonged dry spell. Five on-farm exploratory trials per district were established in three districts which have been hosting CA since 2010 though the trials have been hit by longer dry spell occurred at early growth stage of maize.

**ii. Hawassa Maize research Center (HMRC)**

Exploratory maize and common bean trials have been planted in Hawassa research station in three replications in Badewocho, Meskan and Hawasa Zuria districts. Data collection, monitoring and evaluation, farmers’ evaluations were done as planned. Data on soil, water yield, agronomic, phenology and socioeconomic were collected during the reporting period.

During 2014, 384 male and 59 women farmers as well as extensionists from the three intervention sites were trained on CA-based system intensification as part of technology scaling out. Both on farm (15) and on station exploratory trials were planted on time.

**iii. Bako Agricultural Research Center (BARC)**

During 2013/2014 cropping season, agronomic and soil data for Bako were collected on time. CA trials and technologies were evaluated based on yield, land equivalent ratio (LER), economic benefits, labour productivity, soil properties, soil loss, and water use efficiency. Based on the step by step analysis and evaluation across cropping season, two CA technologies which were identified as best-bet for the Bako area are:

- Maize bean intercropping under CA
- Bean maize rotation under CA.

These technologies will be scaled out in the coming agricultural seasons.

More than 5000 farmers have been trying minimum tillage by themselves from nearby SIMLESA CA hosting farmers. Furthermore, three exchange visits on which 510 farmers invited were conducted at Bako-Tibbe. Exchange visits which coincided with field day was broadcasted through ETV and FM radio in country. A documentary film was prepared as part of documenting SIMLESA work which also serves as teaching material in the long run.

During 2014, five districts, two newly selected this year (Wayu-Tuka in East wollega and Illu-Galan in West Shoa), were selected and 100 farmers were selected per district for scaling out. Half of the farmers from each district were selected to plant maize-legume intercropping while the rest planted legumes under CA to rotate to maize for the coming cropping season, 2015 (See table 2.2). Two days training was conducted to the five district representatives at BARC to aware them what the project is doing, what results were obtained
and the way we could possibly scale up the findings. After the discussion and training, a mandate was given to the representatives each to select 100 farmers for the scaling up activities.
Table 2.2: Number of farmers selected from each district and community

<table>
<thead>
<tr>
<th>Woreda</th>
<th>Community/Kebele</th>
<th>Legume_Maize Rotation</th>
<th>Maize_Legume Intercropping</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Soybean</td>
<td>Haricot Bean</td>
<td>Soybean</td>
</tr>
<tr>
<td>Wayu-Tuka</td>
<td>12</td>
<td>25</td>
<td>25</td>
<td>25</td>
</tr>
<tr>
<td>Sibu-Sire</td>
<td>10</td>
<td>25</td>
<td>25</td>
<td>25</td>
</tr>
<tr>
<td>Gobbu-Sayo</td>
<td>8</td>
<td>25</td>
<td>25</td>
<td>25</td>
</tr>
<tr>
<td>Bako-Tibbe</td>
<td>12</td>
<td>25</td>
<td>25</td>
<td>25</td>
</tr>
<tr>
<td>Ilu-Galan</td>
<td>12</td>
<td>25</td>
<td>25</td>
<td>25</td>
</tr>
<tr>
<td>Grand Total</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

In general, a total of 540 new farmers planted maize intercropped with either soybean or haricot bean and legumes only for crop rotation in the next season. All the farmers attended one day training at their respective district offices to discuss on the result of SIMLESA trials, how to plant CA plots, how to manage the pre-scaling up plots and the advantage of CA in farming as a business.

iv. Pawe Agricultural research Center (PARC)

Data collection of the on-farm and on-station exploratory trials initiated since 2010 is in progress.

During the reporting period two local field days were held in the districts which were attended by over 500 participants. During the field days various training material were distributed for example leaflets, calendars and posters.

The on station exploratory trial (with 8 treatments) was planted on 13 June 2014 after the usual activity of round up spraying which was done 10 days before the planting date. Scaling out of identified technologies is also under way.

SIMLESA Expansion Sites

i. Amhara Agricultural Research Institute (ARARI)

Adet and agricultural research centers are the SIMLESA project implementing centres under ARARI. Andasa research center is responsible for forage aspect while Adet is handling mainly crop research component of the project. All necessary data on maize CA, maize PVS, Legumes PVS, and forage PVS activities were established and data collection was done. Site characterization, amount and price of seed, fertilizer, round up, amount of crop residue retained on the plot in both kg/ha at harvesting, plant counts, labour use, prices for ploughing, planting, weeding and harvesting, phonological stages, pest and disease occurrences were recorded for the on-farm and on station trials.

Conservation Agriculture with maize variety BH-545QPY was selected as best technologies by farmers in both districts last year and this year. According to continuous evaluation and field day of the demo plots the following are noted:

- BH-545QPY best performs under CA in all demonstration plots
• It holds the attention of farmers and other partners and stockholders
• Farmers are very interested and ready to accept it as scalable technology

CA technology dissemination through community awareness creation and training: A total of 92 (83 male and 9 female) were participated. During the training, importance of conservation agriculture based cropping system, roles and responsibilities of IP members (farmers, agricultural offices, community agricultural offices (DA) and Amahara Regional Agricultural Research Institutes) were well addressed. Manuals were prepared in Amharic, language of the target community, and distributed to farmers and other stakeholders. Two field days were conducted at Jabitehnan and South Achefer where more than 486 farmers and 154 participants from different institutions participated.

SIMLESA experiments conducted on farmers’ and on-station field including demonstrations were visited by Adet Agricultural Research Center (AARC) technical team, ARARI management team, project management and technical team, BOARD extension team, Australia Ambassador in Ethiopia with the national SIMLESA project coordinator and Ethiopia CIMMYT scientists. In general, the trials were visited by over 3175 male and 234 female farmers and experts from office of agriculture at different levels during the report period.

ii. Somali Pastoralist and Agro Pastoralist Research Institute (SORPARI)

Data collection from the established trials has been carried out. Minimum data set for field characterization defined and soil profile sample were taken from Jijiga research station from each host farmer field in both Jijiga and Gursum districts for soil analyses.

Field day was organized in each district where farmers and field day participants have selected the following option from on-farm CA explanatory trials as scalable technologies:
1. Maize-haricot bean intercropping (CA)
2. Maize-Lablab intercropping (CA)

In addition, farmers training were organized on CA options and CA trial management, and community awareness creation meeting were hold at farmer training center (FTC) in both Jijiga and Gursum districts to discuss on the major aspect of conservation agriculture (CA) with comparison to conventional practice (CP) with regards of soil fertility, moisture retaliation, and cost of production.

iii. Southern Agricultural Research Institute (SARI)

Data collection has been done for the all trials conducted in the area. Based on result of previous years and 2013 research work, scalable technology identified for 2014 scaling out at Loka Abaya and Boricha districts. The followings are identified technology for scaling out of 2014/2015 cropping season.
- CA + maize/pigeon pea cropping systems
- CA + maize/bean cropping systems
- Demonstration of oxen-pulled ripper

Forage relay cropping trial is being carried out in Awassa on station. Forage relay cropping trial was planted in April, 2014. By this time, maize is at silking stage and important morphology and agronomic data collection is in progress. Relay cropped forage will be planted in July when maize reaches its physiological maturity stage. Pigeon pea intercropping in maize was also another forage trial established in Awassa research station. It was also established at Boricha and Loka abaya on unfenced sites in farmers’ field.
Important agronomic data collection was taken and is under way for maize, and data on days to emergence were taken and establishment of the forage legume looks promising.

**Kenya**

In collaboration with the other project objectives, the second component (objective 2) of the project team continued to manage the CA and maize/legume cropping systems in 21 on-farms and two on-station sites. The 8th set of the trials was established at the start of April 2014 long rains. It is on these trials that short-, medium and long-term data sets on climate, soil, crops and field management are collected to determine the effects of CA practices on soil nutrients and crop yields balances. The said sites have further been the venues for out-scaling and training partners on various topics on implementation of CA, and also the suitable maize and legume varieties to go with CA tillage methods. The component gave extra effort in out-scaling the project technologies. This was possible due to inputs provided by the members of innovation platforms in the four sites. Part of this has been strengthening of activities and processes of LIPs and also establishment and management of mega demonstration four sites, one in each site to. The mega demos are currently the key venues for demonstrating the community endorsed project’s CA and maize-legume varieties in the region. The demonstrated project benefits are carried out together with those of partners or IP members. For example, CASFESA and Precision Nutrient Management projects assisted in reaching for partners in Embu and Kirinyaga counties.

**Impact assessments of farm households**

Training and pretesting of household and individual questionnaires for the second round of data collection after the baseline survey conducted in 2011 (second wave of survey) was done for one week in the third week of September 2013 jointly with the pathways project. Adjustments were then made accordingly. The survey covered baseline farmers in Embu, Meru South and Imenti South. The survey was carried out for 30 days which started at the end of September 2013. Individual questionnaires were administered to husband and wife in the same households to understand gender dynamics in decision making. In addition joint questionnaire was also administered. 285 households were interviewed compared to 300 in the baseline of 2011, giving attrition rate of 5%.

**Community awareness meetings**

Six community awareness meetings were conducted in each of the operational sites. The meetings had three crucial program components on the agenda: 1) introduce SIMLESA project in new areas, 2) discussion on SIMLESA implementation framework and accrued technologies, 3) how to scale-out the project technologies through partners.

**Local Innovation Platforms**

The project continued to encourage the 4 LIP initiatives in Kyeni, Mweru, MWoroga and Mariani to overcome operational challenges. Two exchange tours, 3 farm to farm monitoring, 1 joint field day and 2 workshops were conducted with participation of 240 members (160 females and 80 males) from Eastern Kenya partners. In addition 2 meetings/workshops were held to strengthen the LIP initiatives in the region as well.

**Tanzania**

Activities under objective two of SIMLESA were implemented according to plan in Tanzania during the reporting period as detailed below:
i) Thirty four (34) exploratory trials were established in four villages in the northern zone implemented, namely, Masqaroda, 9 trials, Bargish-Uwa 9 trials in Mbulu district, and Bashai 8 trials and 8 Rhotia communities in Karatu district. In Mbulu District, seeding was done on the second week of December while in Karatu District it was done on last week of February 2014. Harvesting is ongoing in Mbulu district. The maize in Karatu district is at physiological maturity stage of crop development. In eastern zone, 35 exploratory trials were established in six villages across the three districts, namely, Gairo district (Msingisi village), Kilosa district (Dodoma Isanga, and Mandera villages) and Mvomero district (Vitonga, Milama and Makuyu villages). This 2014 cropping season crop establishment was good since normal to above normal rains were received.

ii) Eleven researcher managed trials implemented during the 2013 cropping season were harvested before December 2013 and data has been analyzed, compiled and reported. During the 2014 cropping season, 18 researcher managed trials were implemented. One Long term on station trial was established at Ilonga Agricultural Research farm. Four intercropping trials involving maize + pigeon-pea varieties and Maize + Cowpea varieties were established on station and on farm in the eastern zone. Additionally, 6 trials were established at Ilonga Research Station, Kilosa. Furthermore, 3 trials, one long term and 2 component trials were established at Selain Agricultural Research Institute. Crop performance of long term trials at Selian and Ilonga Kilosa during the 2014 cropping season was better than during the 2013 cropping season.

iii) During June to September 2013, a total of six field days were conducted in five operational districts at physiological maturity of maize. Participants included district, DAICOs, village leaders, researchers, extension staff, farmers, NGOs and representatives from seed companies. In the northern zone field days were held at Bargish Uwa village (100 males and 350 females) and Masquaroda 450 males and 180 females in Mbulu districts. In the eastern zone, field days were held at Misingisi village (282 males and 174 females) in Gairo district and at Mandera village (255 males and 205 females) in Kilosa district.

iv) Soil samples were collected in all farms for field characterization, determination of initial soil condition. In addition soil extensive sampling was done on one farm in each village together with researcher managed trials at Karatu and on station for characterisation of soils for plant available water capacity (PAWC). Variables for PAWC such as bulk density, soil moisture content have been determined. Soil analysis (for initial soil condition and nutrient flow during the 2013 cropping season has been completed and will be reported in the CA World Congress in Canada. Fifteen farmers from Karatu and Mbulu districts in the northern zone visited Mvomero and Kilosa districts in the eastern zone during September 2013. Five district level Innovation platforms (IP) established in five districts namely, Karatu and Mbulu in the northern zone and Gairo, Mvomero and Kilosa in the eastern zone were strengthened. Members of IP included village leaders, researchers, extension staff, farmers, NGOs, CBOs and input providers. Members of IP were involved in site and farmer selection, motivation of farmers to engage in CA. In addition, 4 and 6 IPs were established at community level in the five districts in the northern and eastern zone, respectively. The newly established LP have received training both in the northern and eastern zone of Tanzania and have gone one cycle of problem identification and find solutions for respective problems during 2014 cropping season. The second round has already been planned and is due
for implementation at physiological maturity stage of development of maize.

Malawi
In Malawi objective 2 activities were implemented with much focus of achieving the main objectives of testing and developing productive, resilient and sustainable smallholder maize-legume farming systems during the reporting period. In six SILESA districts, on-farm exploratory conservation agriculture trials were implemented. All were managed by extension agents with close supervision by researchers. Other activities carried out were:

Planning and review meeting at Chimoio, Mozambique

Agronomic results for 2012-13 cropping season from on-farm trials were presented and reviewed. Work plans for the 2013-14 cropping season were presented and reviewed before implementation. SIMLESA best bet technologies for Malawi were identified for out scaling. Nongovernmental organizations (NGOs) that were operating in Malawi were careful selected by key stakeholders for scaling out SIMLESA technologies. The selected partners are Total Land Care Malawi (TLC), Catholic Development Commission in Malawi (CADECOM), National Smallholder Farmers Association of Malawi (NASFAM), FUNWE Farms, National Association of Smallholder Farmers of Malawi (NASFAM) and The Clinton Hunter.

Partners who participated in the review and planning review meetings in Mozambique committed their effort to out-scale best bet technologies through signing the CIMMYT/DARS drawn MOU. During the meeting with stakeholders prior to signing MOU, CIMMYT/DARS had a meeting with the partners. This meeting provided a platform for mutual understanding of the SIMLESA activities and that of partners; understanding the notion and interests of stakeholders. This was of paramount importance in reducing conflicts of interests or duplication of activities which will not be cost effective.

Implementation of on-farm field trials

Prior to implementation of core on-farm trials and out-scaling demonstrations, agricultural inputs were purchased; protocols prepared and distributed to respective coordinators in readiness for implementation in all SIMLESA project sites. A total number of 35 on-farm exploratory trials instead of 36 were implemented. In Lilongwe, one farmer migrated and sold his land including the trial site, leaving a total of 5 farmers instead of 6. A total of 240 out-scaling plots were planned to be established in the six participating districts i.e. 40 out-scaling plots per district.

Out-scaling CA best bet technologies

In an effort to out-scale different CA best bet technologies in the SIMLESA implementing districts, more than 40 farmers per district were supported with inputs to carry out this exercise. Additionally, nongovernmental stakeholders also had taken a leading role to out-scale some of the identified best bet technologies into new communities. In order to achieve significant success of CA adoption, innovation platforms were used, where additional stakeholder were identified to assist with out-scaling activities. Local comedies were formed and used to disseminate the best technologies in their messages. A harmonized protocol for implementation of demonstrations across different participating partners was developed and shared amongst.
Mozambique

Objective 2 harvested 36 CA exploratory trials and six long term trials placed at ISPM and in Angonia covering different studies. The trial studies were:

1) 1 trial with 12 treatments with different CA options;
2) 1 for termite control options and 1 for weed control options and Angonia Research Station
3) 1 crop intensification trial.
4) 2 fields with CA, 1 in Angonia and another in Sussundenga were selected for APSIM data collection.

All the trials are continuing for the 5th consecutive year in order to access the long term effect of CA in maintaining soil fertility.

Local innovation platforms (IP’s) were established in 3 sites. 106 Outscaling trials from those IP’s (laid down in Manica Angonia, Sussundenga and Gondola districts with the best bet treatments in new communities (4 in Manica IDEAA), in Angonia (TLC) and 2 in Gondola (ISPM)) were successful harvested.

The number of outscaling trials and hence the coverage of farmers was increased for the season 2013/14 as part of outscaling efforts as follows:

1) TLC from 12 to 48 farmers (Angonia)
2) UCAMA from 12 to 18 farmers (Gondola)
3) IDEAA-CA from 12 to 48 farmers (Sussundenga and Gondola)
4) ADEM from 0 to 18 farmers (Gorongosa)
5) ISPM from 6 to 12 farmers (Gondola)

It was also agreed that every 6 trials should cover on average 1,200 farmers. MoU was drawn with all relevant partners. Protocols have been distributed after farmer’s selection. Inputs and materials and a small amount of cash to purchase other materials and inputs were allocated to all IP’s.

Australia

Activities carried out in the previous year, July 2013 to June 2014 include:

- Queensland research on opportunities for the intensification of summer cropping have confirmed that relay cropping a legume crop into a standing maize crop with high levels of stored moisture during grain filling can double land productivity and farmers profits in a second year of on-station experiments.
- So far APSIM has been used to simulate on-farm and on-station experimental results from all 5 SIMLESA countries and from 6 of the 11 agro-ecologies.
- Participatory modeling and initial farmer engagement in Ethiopia’s Central Rift Valley region helped frame research questions for Solomon Hassen’s research project.

APSIM modelling activities

- Improved APSIM capability for simulating growth and yield of bean crops as sole and intercrops evaluated using on-station results from Melkassa and Bako sites (poster presentation at the Project Annual Meeting, Chimoio, 2013) (by John Dimes).
- APSIM model analysis by Malawi agronomists highlighted that well fertilised continuous maize crops have potential to input higher levels of soil carbon than maize-legume rotations because of the much larger biomass yield of the maize crops (by John Dimes).
• Simulation results of on-station results at Harare workshop highlighted complete absence of short term yield differences between CA and Conventional tillage in well fertilized improved maize systems and strong yield ceilings for low stature legume species when intercropped with well fertilized maize (by John Dimes).
• So far APSIM has been used to simulate on-farm and on-research station experimental results across all SIMLESA countries. For example labour saving (DSSAT) and soil moisture benefits of mulching (APSIM) in CA systems have been modelled to assess early sowing benefits to maize production in Zimbabwe, Malawi and Mozambique. DSSAT results for Zimbabwe presented at Farming Systems Design Conference, China, August 2013. Analysis approach and results to be combined and prepared for journal publication (by John Dimes).
• Model analysis of climate-related production risk and its response to fertiliser inputs across SIMLESA sites (n=14) in Eastern and Southern Africa are being prepared for journal publication (by John Dimes).
• Model analysis outputs generated for economic analysis of CA technology interventions at Bako and AdamiTulu sites in Ethiopia (Yohannis PhD Confirmation Study, Qld Univ) (by John Dimes).

Objective 3: Increase the range of maize and legume varieties available for smallholders through accelerated breeding, regional testing and release, and availability of performance data.

During the reporting period, under objective 3 key activities carried out are participatory variety selections, experimental trials, GxExM analysis, scaling out of improved technologies and test cross formation. Table 3.1 summarizes objective achievements.

The table 3.1 Objective 3 progress summary

<table>
<thead>
<tr>
<th>Output</th>
<th>Milestone</th>
<th>Date due</th>
<th>Status/ comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.1. Ten to 15 stress tolerant maize varieties, 10 higher yielding legume varieties and five appropriately adapted fodder/forage species available to farmers in the selected farming systems through farmer- and seed company-participatory variety evaluation and release</td>
<td>3.1.2: Per farming system, 1-2 potential legume species and two varieties each for the target communities identified</td>
<td>Dec 2010</td>
<td>Ongoing</td>
</tr>
<tr>
<td></td>
<td>3.1.3: Seed for farmer-participatory maize and legume variety evaluation</td>
<td>Dec 2010</td>
<td>Ongoing</td>
</tr>
<tr>
<td></td>
<td>3.1.4: Maize hybrids and OPVs and OPVs and legume varieties of different species suitable for the targeted farming system</td>
<td>Dec 2011</td>
<td>Done and ongoing</td>
</tr>
<tr>
<td></td>
<td>3.1.5: Per country, 3 productive maize hybrids and OPVs and 2 legume varieties suitable for the targeted farming system identified</td>
<td>Dec 2011</td>
<td>Done but ongoing</td>
</tr>
<tr>
<td>3.2. Regional nursery for further improved (2nd generation) maize and legume varieties and hybrids</td>
<td>3.2.4: Testcross characterization in various legume systems</td>
<td>Dec 2012</td>
<td>Done</td>
</tr>
<tr>
<td></td>
<td>3.2.7: Irrigation for nurseries, contribution to cold room maintenance</td>
<td>Dec 2012</td>
<td>Done in Kenya and Tanzania</td>
</tr>
</tbody>
</table>
Ethiopia

In Ethiopia under objective three of SIMLESA project, main activities accomplished were PVS, seed increase, varietal characterization (distinctness, uniformity and stability (DUS), performance and yield potential), trial management, data collection, PVS evaluation and field days. These activities were implemented in the previous 12 months, July 2013 to June 2014. Achievements are detailed in the attached Ethiopian report.

Participatory variety selection (maize, legume and forage PVS)

During the reporting period, 37 (11 maize, 18 legume and 8 forage) PVS trials were established as detailed by table below. The main objective of these trials is to ensure selection of best performing varieties in each agro-ecology of SIMLESA operational sites. The PVS approach for each crop was conducted on farmers’ fields under sole and intercropped condition. Both the local and regional M&E teams visited most of these PVS trials during the reporting period.

Table 3.2: Number of trials and varieties tested in each of the three crops (maize, legume, and forage) at each study area.

<table>
<thead>
<tr>
<th>Study area /Center</th>
<th>Number PVS Trials</th>
<th>Number varieties evaluated under PVS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Maize</td>
<td>Legume</td>
</tr>
<tr>
<td>ARARI</td>
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<tr>
<td>BARC</td>
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<td>2</td>
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<tr>
<td>HARC</td>
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<td>3</td>
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<tr>
<td>MARC</td>
<td>-</td>
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</tr>
<tr>
<td>PARC</td>
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<td>2</td>
</tr>
<tr>
<td>SARI</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>SORPARI</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>11</td>
<td>18</td>
</tr>
</tbody>
</table>

Maize PVS

Variable numbers of released and pre-release improved maize varieties were tested in each of the six study areas on farmers’ fields under conventional and conservation agriculture (CA) systems including sole or intercropped condition. A total of 61 maize varieties were evaluated under 11 PVS trials. Under ARARI three sets of maize PVS trials were conducted both on station (Adet and Fenotselam) and farmers’ fields at
two districts (south Achefer and Jabitenane), while SARI evaluated seven varieties both under conventional and CA farming system at six kebles in two districts (Borecha and Loka Abaya).

Farmers’ preference in northern-western part of the country was different from location to location and at different stages of the crop. Farmers preferred as the first and second choice BH-670 and BH-661 respectively at flowering stage at Jabitehnan district from the first set of trial. But PBH-3253(Jabi) and AMH-850 (wonchi) were the first and the second choices at South achefer at the same stage. In the same manner BH-670 and AMH-851(Jibate) were the first and the second preference at maturity at Jabitehnan. And farmers at south Achefer selected BH-660 and BH-661 as first and second choice at this stage.

On the other hand, three sets PVS trials were also conducted in the southern part of Ethiopia especially at the three districts (Hawassa Zuria, Meskan and East Badawacho) on farmers’ fields and experiment station by Hawassa Maize sub-research Center. Similarly, seven, nine and six improved maize varieties were evaluated under Bako, Pawe and Jijiga (SoRPARI) research centers respectively. At each study area, superior varieties selected through farmers’ participatory evaluation. Accordingly, most farmers in southern part of the country (SARI) selected Shala followed by BH-540 based on their performance. Based on Hawassa Maize sub-research Center’s report, Kuleni-320-2-3-1-1/DE-78-Z126-2-2-1-1(g)/CML312 gave the highest grain yield under sole condition when compared with the two checks (BH546 and BH547). However, BH546 was the best and most farmers’ selected under intercropped condition followed by BH547.

Legume PVS

Under ARARI, three set of legumes PVS trials with (BH QPY-545) intercropping were conducted: (1) 8 faba bean; (2) 8 haricot bean, and (3) 8 soybean varieties. On the other hand, 10 common bean varieties were evaluated under conventional and conservation tillage under SARI. From these, Tatu, Remeda and Waju were released in 2014 after the evaluation under conservation and conventional tillage.

Under Hawasa Maize Research center(HMARC), nine varieties with two recently released common bean varieties were tested both on farms and on-station. Hawassa Dume was preferred by most farmers at Hawasa zuria and Badiwacho, while Ibado at Meskan district. However, the highest grain yield was recorded from Nassir (6.95 ton ha⁻¹) and SER-180 (6.76 ton ha⁻¹) and Hawassa Dume (6.4 t ha⁻¹) at Hawassa Experiment Station. Moreover SER-119 gave the highest biomass yield (30t/ha) at the station. At Bako, SER-125 gave highest yield and most preferred followed by SER-119 and SER-48.

Forage PVS

With the objective of selecting and demonstrating alternative feed production system 32 varieties of different forage crops were tested under intercropping and sole condition farming systems. However, promising results recorded mainly by ARARI. Under this study area, six cowpea (Vigna Unguiculata) varieties (cowpea 9333, cowpea 9334, cowpea Bekur , cowpea TVU, cowpea Balck eyebean, cowpea 12688) were evaluated on six farmers’ fields and one FTC (seven locations) under intercropped condition with maize (BH670). At both districts (South achefere and Jabitehnan), cowpea balck eyebean was selected as the best considering its superiority in performance under intercropping system and farmers’ preferences.

Under HMRC, five forage species were tested for biomass yield and forage value at both on farms and on-station. Based on field performance, pigeonpea was ranked first by farmers at Hawassa-Zuria and Meskan districts but cowpea-1726 at Badawacho where it gave the highest yield (108.88 t/ha) especially when measured at flowering time was considered as the best in that district.
**Ethiopian achievements in promotion of improved varieties**

In 2013/14 cropping season, the promotion of farmers’ selected and released maize, legumes and forage varieties were conducted in the project intervention sites. With the effort made to disseminate information on the varieties, different promotion materials such as leaflets/pamphlets and banners produced and distributed to field day participants in all locations. About 1751 (male) male and 527 (female) on farm demos of different varieties of maize, legume and forage conducted. On the other hand more than 5211 male and 769 farmers including IP members and partners visited the technologies during the exchange the exchange visits. Promotional activities were conducted in collaboration with different project partners including office of agriculture, NGOs, research, seed companies and community organizations. Besides, about 1777 (male) male and 527 (female) participated on field days organized on maize demonstration plots/PVSs organized in different locations while 1513 male and 250 female farmers and IP members and partners on field days organized on legumes. Similarly, a total of 2977 men and 308 female participants attended the field days organized on forage trials/demos. Besides, field day programs were recorded and broadcasted in different languages mainly using different TV and radio programs all over the country. More than 10 TV and radio programs each were broadcasted and more than 5,000 Leaflets/Pamphlets and banners were produced and disseminated.

**Kenya**

The objective 3 team (scientists, seed companies, stockiest and farmers) continued with formal and informal evaluation and promotion of community endorsed maize and legumes varieties in the initial project site and beyond-scaling out sites. This went on well using participatory variety selection approach with local innovation platform (LIP) members in all four sites. The process of hybrid seed production to meet the seed road map was continued with the partners and scientists providing backstopping. Breeder’s seed trials were planted on-station. In addition certified seed increase went on at Migotyo plantations with backstopping from the project objective 3 team members. The team also continued to monitor the 24 pigeon pea trials in Mworoga and Mariani sites.

**Tanzania**

Objective three activities were implemented as planned both in the northern as well as eastern zone. Activities done during the 2013 cropping season were:-

i) Participatory Variety Selection (PVS) with farmers during the June to December 2013. Ten maize varieties, namely, TZH 536, TZH 538, SELIAN H 208, SELIAN H 308, IF 510, SC 627, H 614 D, LISHE H2, CKH 10692 and MERU HB 513 were evaluated in northern zone. Similarly, twelve maize varieties, namely, TMV 1, ZM 309, ZM 525, SITUKA M1, ZM 523, SELIAN H 208, SELIAN H 308 TAN H 600, TZH 538, MERU, HB 515, MERU HB 513 and MERU HB 409 were evaluated in the eastern zone. In addition, 7 pigeonpea varieties, namely ICEAP 00936, ICEAP 00576-1, ICEAP 00040 (MALI), ICEAP 00911, ICEAP 1514/15, ICEAP 00850 and ICEAP 00068 (TUMIA) were evaluated in the northern zone and 6 pigeon pea varieties, namely, ICEAP 00554, ICEAP 00557, ICEAP 00053, ICEAP 00932, ICEAP 00040 (MALI) and ICEAP 00068 (TUMIA) were evaluated in PVS in the eastern zone. During the 2014 cropping season, maize varieties planted for evaluation included WE2109, WE2112, WE2113 and NPT candidate varieties, namely, CKDHH4101,
CKDHH4102, and CKDHH4103 in the eastern zone. Similarly legume varieties evaluated in the PVS included pigeon pea and cowpeas. Six pigeon pea namely, Mali (ICEAP 00040), ICEAP 00576-1, ICEAP 00936, ICEAP 01514/15, ICEAP 00911, ICEAP 00850, Tumia (ICEAP 00068) and 5 cowpea varieties namely VULI 1, VULI 2, IT99K-1122, IT00K-12 TZH 536, TZH 538, SELIAN H 208, SELIAN H 308, IF 510, SC 627, H 614 D, LISHE H2, CKH 10692 and MERU HB 513 were seeded for in PVS for evaluation during the 2014 cropping season.

ii) Seed increase of the pre-release and newly released maize and pigeon pea varieties produced during the 2013/14 cropping season for targeted maize hybrid Selian H 208 was 70 kg, 30 kgs and 70 kgs for parent 1, parent 2 and parent 3, respectively. Breeder seed for the targeted pigeon pea was 500 kgs for the ICEAP 00557, 150 kgs for the ICEAP 00554. In addition, licensing of the maize and pigeon pea protected varieties to private seed companies was done during the reporting period.

Malawi

The following activities were carried out during the reporting period under objective 3 in Malawi:

Scaling-up of maize and legume seed production

Quantities of breeder/basic seed of inbred lines and single cross hybrids for newly released maize hybrids (MH30, MH31, MH32) were distributed and shared between the Department of Agricultural Research Services (DARS) and Private Seed Companies for multiplication. The seed companies that were involved in the multiplication program were Funwe Farm, Peacock Investment Limited, Demeter Agriculture Limited and CPM Agri-enterprise limited. The aim of this seed multiplication program was to produce more seed that would be made available to the farmers during next growing season. There was high demand for using improved maize and legume seeds by smallholder farmers creating a market for seed companies.

Mozambique

The main focus of objective three was to increase the maize and legume varieties available for small-scale farmers in the country. In order to do this, various activities were undertaken and numerous achievements have been recorded so far. Some of the achievement highlights are:

- Identification of specific maize and legume released varieties suitable for targeted farming systems.
- In three years of project implementation a total of 22 varieties of legumes and 12 of maize have been identified. The varieties are products of DTMA / TL-II, IIAM maize program and other projects and local seed companies (Table 3.3).
Table 3.3: Identified specific maize and legume released varieties, suitable for the targeted farming systems and agro-ecologies of Mozambique

<table>
<thead>
<tr>
<th>Crop</th>
<th>Name of Varieties</th>
<th>DTMA/TLII</th>
<th>IIAM Maize Program</th>
<th>Seed companies</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maize (OPVs)</td>
<td>Tsangano, Chinaca, Djandza, ZM523, Dimba, ZM309</td>
<td>5</td>
<td>1</td>
<td>0</td>
<td>6</td>
</tr>
<tr>
<td>Maize (Hybrids)</td>
<td>Hlvukane, Olipa, Molocue, CZH04008-SP-1, PAN67 and PAN53</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td>Beans</td>
<td>Cal 143, Sugar 131, Diacol calima</td>
<td>3</td>
<td>0</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>Pigeon pea</td>
<td>ICEAP00040. ICEAP 00020</td>
<td>2</td>
<td>0</td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>Cowpea</td>
<td>IT 16, IT 18, IT 36, INIA 36</td>
<td>4</td>
<td>0</td>
<td></td>
<td>4</td>
</tr>
<tr>
<td>Soybean</td>
<td>H7, H17, H10, H19, H 16, Ocephara 4, TGX1740-2F, 427/5/7</td>
<td>8</td>
<td>0</td>
<td></td>
<td>8</td>
</tr>
</tbody>
</table>

- Evaluation of maize and legume varieties under farmer-representative environment using Mother and Baby trials approach and PVT.

- A total of about 16 maize improved varieties were evaluated in three years on mother baby trials. The entries per year in the mother trial were 9 in 2012 and 12 in 2013 and 14. Some of varieties were tested two to three times and others only once (Table 2),

- In 2014 three open pollinated varieties (ZM721, ZM621 and ZM401) from DTMA were included on mother and bay testing trials

In overall the project results are positive and the targets are being achieved. The major achievement is seen with the socio economic studies and the agronomic practices and trials. The farmers are satisfied with technologies disseminated and have introduced changes in their cropping systems that include: sowing in line, crop rotation and intercropping, use of herbicides and fertilizers (still in very low quantities).

Australia: QAAFI in association with QDEEDI

The modelling based GxExM analysis framework has been shown to be an effective tool to integrate variety development and crop management optimization for sustainable productivity improvement (by Solomon Fekybelu and Yash Chauhan).
was obtained from six African countries, and simulations are being run using three different check varieties for a total of 29 distinct environments (by Solomon Fekybelu and Yash Chauhan).

**Objective 4: Support of Regional and Local innovations systems (ASARECA)**

During the reporting period, the following key activities were carried out under program objective 4. Table 4.1 below summarizes program achievements under objective four.

Table 4.1 below outlines the relevant outputs and milestones during this reporting period

<table>
<thead>
<tr>
<th>Output</th>
<th>Milestone</th>
<th>Date due for implementation</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.1. Mainstreaming of gender sensitivity in research activities in the five primary program countries</td>
<td>4.1.1: M&amp;E system incorporates gender aspect</td>
<td>December 2012</td>
<td>Done</td>
</tr>
<tr>
<td></td>
<td>4.1.3: NARS scientists in Ethiopia, Kenya, Tanzania trained in implementing gender issues into research design, monitoring and evaluation</td>
<td>December 2012</td>
<td>Done and ongoing</td>
</tr>
<tr>
<td></td>
<td>4.1.4: Understanding of processes and compilation of data on effects of gender sensitive research designs</td>
<td>December 2012</td>
<td>Done.</td>
</tr>
<tr>
<td>4.2. Functioning program M&amp;E system incorporated into the program providing information system assessments to national and regional program managers</td>
<td>4.2.1: Functioning common M&amp;E system established based on experiences in eastern Africa</td>
<td>December 2012</td>
<td>Done and ongoing</td>
</tr>
<tr>
<td></td>
<td>4.2.2: NARS scientists in five program countries trained in implementing common M&amp;E system in ten local innovation systems</td>
<td>December 2012</td>
<td>Done</td>
</tr>
<tr>
<td>4.3. Knowledge of relevant program innovations and germplasm available in five additional countries in the region</td>
<td>4.3.3: Maps demonstrating agro-ecological analogues between Australia and eastern and southern Africa as well as Conclusions for effective sharing of research results on CA-based maize/legume systems in eastern and southern Africa</td>
<td>December 2012</td>
<td>Done and ongoing</td>
</tr>
<tr>
<td></td>
<td>4.3.4: Shared understanding of regional research challenges and products; sharing of innovative agronomy, breeding and socio-economic research methods and maize-legume system products</td>
<td>December 2012</td>
<td>Done and ongoing</td>
</tr>
</tbody>
</table>
During this period, the gender Mainstreaming Unit (GMU) contributed to SIMLESA project activities by providing technical backstopping in gender mainstreaming. This is to support the overall program objective of ensuring the integration of gender aspects in the different activities of SIMLESA. During the year, M&E provided the backstopping inputs through conducting tailor-made training and periodic updating of the master program performance monitoring plan (PMP) and performance measurement framework (PMF) and participating in the program meetings. Under knowledge transfer, the main activity was finalizing the synthesis and publication of the output of the study on inventory of available SIMLESA technologies (Maize, Legume and CA), dissemination methods and conditions for facilitating knowledge & technology transfers and spillovers. The publications were disseminated at the 4th ARPM held in Addis Ababa in April 2014.

The following are the detailed activities were carried out under the three components during the reporting period.

**Gender Mainstreaming**

**Capacity building**

Experience from the field and different observations demonstrate that there is a need for additional and continues capacity building on understanding of gender specifically gender mainstreaming in agricultural research for development and its application in real life. Therefore, financial assistance and technical backstopping was provided to undertake gender training in participating countries. The amount of 5000 USD each was transferred to Ethiopia, Malawi, Mozambique and Tanzania based on their action plan. Kenya, was not included as part to transfer the money due to differences in agreement of accepting some of the statements in the sub-grant agreement. The report obtained from Malawi, Mozambique and Ethiopia are summarized in this report.

**Training**

Training reports were obtained from four SIMLESA member countries Ethiopia, Malawi, Mozambique and Tanzania. The procedure was nearly similar in all the training processes. The approach used by the Ethiopia and Mozambique group promotes gender disaggregated field data to be used as a major guide for project appraisal and its implementation. The approach used by both groups is regarded as pertinent and applicable attempt to ensure full integration of gender in programme /project activities of SIMLESA. The major recommendations drawn from the report needs to be further designed and shared with other SIMLESA groups. Summary of the recommendation indicated as follows.

- Understand and recognize household dynamics, their resource base and its management practices for project appraisal and implementation
- Focus on factors influencing demand as related to values, norms and economic reasons for choosing technologies
- Recognize differences between women’s and men’s resource and time allocation
- Establish a system for gender responsive monitoring and evaluation
- Identify priority needs and initiate SIMLESA activities specific to women and youth economic empowerment
- Focus on designing a strategy on how to engage the youth in SIMLESA activities
• Encourage and design the use of gender disaggregated data and promote gender responsive reporting for project design, monitoring, evaluation and learning

Validation of case study findings

In September 2013, The GMU has organized a meeting to validate case study report on “good practices and lessons learnt in gender mainstreaming initiatives of SIMLESA”. SIMLESA country representatives and SIMLESA country gender focal persons participated from all member countries Kenya, Ethiopia, Malawi, Mozambique and Tanzania. The case study report was presented and discussed. Reflections from participants were captured to enrich the document and country representatives were requested to provide additional input where it was appropriate. The case studies brought out a range of issues that needs a follow up as a lesson for future research design.

Review workshop conducted

SIMLESA gender mainstreaming review workshop held on 23rd march, 2014 with member countries. Progress, and challenges were discussed and information was summarized to indicate in achievement and challenges.

Policy Brief developed

Draft Policy brief was developed to indicate the contribution and its effectiveness of gender mainstreaming in SIMLESA activities. The draft policy brief is shared among partners and is work on progress for final publication.

Attended Annual review meeting (April 7 – 11, 2014)

ASARECA attended the Annual Regional Review, Planning and Program Steering Committee meeting for the Sustainable intensification of maize-legume cropping systems for food security in Eastern and southern Africa (SIMLESA) which was held 7 – 11 April, 2014 in Ethiopia. Challenges and recommendations under the different objectives were discussed for future consideration in the next phase of the project. It is suggested that the gender mainstreaming activities should be part of the project designing for its effective implementation. An exhibition was also hosted and publications and information generated from the project shared with other scientists.

Monitoring and Evaluation

Capacity strengthening: ASARECA M&E Unit conducted tailor-made trainings in M&E for selected SIMLESA implementers from all the 5 countries. A total of 19 people (14 males; 5 females) benefited from assorted M&E themes, especially:

• Introduction to M&E Principles
• Performance Monitoring Plans (PMP) and Measurement Frameworks (PMF)
• Managing for Development Results (Results-Based Management)
• Data Quality Assessment &Management
• Measurement of Qualitative Indicators
• Introduction to Impact Evaluation.

**Technical support:** A series of M&E backstopping engagements with SIMLESA implementing teams were conducted. For instance, 2 M&E review meetings were convened by ASARECA M&E Unit. One was held in October 2013, while the other in March 2014. During the review meetings, key challenges were documented, action points were developed, and strategies for addressing them implemented. Other forms of engagement were through face-to-face discussions, email and phone calls.

**PMP Updates:** The M&E Unit has also periodically updated the SIMLESA Master Performance Monitoring Plans (PMP) and the Performance Framework (PMF). This Master PMP summarizes the data from the country-based PMPs, and provides up-to-date data on SIMLESA’s performance against annual targets. It has also been used to develop action plans to address areas with gaps (based on performance against indicator targets).

**Annual Regional Planning & Programme Steering Committee Meeting:** ASARECA’s team participated in the Annual Regional Planning meeting in Addis Ababa, Ethiopia in April 2014. In this meeting, the progress and achievements of SIMLESA were presented. These included summary of activities, including an M&E report that highlighted the project performance against milestones and indicators in the results framework, details including presentation are attached.

**Achievement against outputs/milestones**

**M&E Review workshop:** Among other roles, ASARECA oversees the Monitoring and Evaluation function of the SIMLESA program. As such, the M&E unit of ASARECA convened and facilitated two workshops, one in August 2013, (attended by 14 people – 11 male; 3 female) and the other in March 2014 (attended by 17 people – 13 male; 4 female). During the workshops, performance against targets, including outcome- and impact-level indicators was assessed. The workshops were attended by Country M&E focal persons, some Objective leaders and National Country Coordinators from the five SIMLESA participating countries, viz. Mozambique, Malawi, Tanzania, Kenya and Ethiopia. The second workshop was not only a build up on the previously held M&E workshops, but one that was organized in preparation for the SIMLESA end-of-phase-1 Evaluation. Through these workshops, the SIMLESA program achieved the following:

- Jointly updated the country as well as SIMLESA Master Performance Monitoring Plan (PMP);
- Equipped the implementers with practical skills to undertake field qualitative data collection, analysis and report writing;
- Endowed the M&E Officers and other implementers with advanced practical skills to undertake data quality assessment and management; and charted a very clear roadmap of the future SIMLESA M&E agenda.

**Knowledge Transfers and Spillovers**
The synthesis and publication of output from the spillover study was completed during this period. The objectives of the study were (i) conduct spillover analysis to document past experiences and bottlenecks in formal and informal transfer of technologies, practices and knowledge products from project countries to non-project countries; (ii) identify the policy, institutional and biophysical conditions that enable smooth exchange; (iii) inventory of the available technologies, practices and knowledge products that are transferable from project countries to other relevant countries. The publication is available in two volumes: Vol1 is the main report. It documents the available technologies for maize, legumes and conservation agriculture practices; knowledge products and dissemination practices across the five SIMLESA countries; results of the analysis of factors that enable or constrain scaling out and spillovers, and provides sets of recommendations. It also contains several case studies of successful scaling out of the SIMLESA technologies. In Vol 2 contains the annexes, which include findings from the desk review and field notes from the country field work. The publications are posted on the ASARECA website for wider dissemination and use.

Observations and Lessons learnt

- It necessary to create critical mass through capacity building to address problems related to few gender specialists among agricultural researchers, and project implementers.
- Research quality and impact will improve when depend on the feedback of sex and gender disaggregated data from the field.
- Designing innovations that can engage the youth and empowerment of women will contribute to improved productivity
- There was no gender mainstreaming training for Kenya, because the funds could not be disbursed due to the gap in signing the sub-grant agreement.
- Clarity on procedure of gender integration and gender mainstreaming and its application as related to tools for the field, statistical gender disaggregated data analysis, interpretation and reporting for action
- Baseline surveys and development of PMP should be done before project implementation
- More resources should be allocated for M&E activities
- The indicators seemed to have been many (45), preferably these indicators could be reduced
- Data quality management should go beyond checking/ verifying the data collected, but also incorporate aspects to do with sharing and storage of data
- Counterfactuals should be used in communities to measure impact attributable to SIMLESA
- SIMLESA team should use M&E data as a source of information during decision making
- Data collection should go beyond collection of sex disaggregated, to include gender disaggregated data
- Develop common data collection tools to cater for indicators that are difficult to validate
• There is need to provide feedback to various stakeholders after data collection and generation of reports
• M&E officers can use key stakeholders as a source of data; this would greatly reduce on the cost of data collection.

**Objective 5: Capacity building to increase efficiency of agricultural research today and in the future**

Table 5.1: Relevant outputs and milestones during this reporting period are outlined in the below:

<table>
<thead>
<tr>
<th>Output</th>
<th>Milestone</th>
<th>Date due for implementation</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.2. Training course on simulation model utilization and participatory evaluation</td>
<td>5.2.1: Capacity built in the program countries in utilizing the outputs from systems modeling to evaluate technology options and risk management strategies; and assist in ex-ante analysis of technology options and farming systems designs</td>
<td>December 2012</td>
<td>Work is continuing. Agronomists from all countries have been to Australia for further APSIM training</td>
</tr>
<tr>
<td>5.3. Training on cropping systems management research including the principles and practice of conservation agriculture</td>
<td>5.3.1: One training course of one week duration held for approximately 25 agronomists in each of the program countries</td>
<td>December 2012</td>
<td>Ongoing</td>
</tr>
<tr>
<td>5.4. Training on crop improvement</td>
<td>5.4.1: Regional training course including 5-10 maize and legume breeders from partner countries</td>
<td>December 2012</td>
<td>Ongoing in collaboration with DTMA.</td>
</tr>
<tr>
<td>5.5. Training on APSIM model parameters</td>
<td>5.5.1: Two CIMMYT staff trained in environmental characterization</td>
<td>December 2012</td>
<td>To be done</td>
</tr>
</tbody>
</table>

Below are the specific details on achievements of the outputs and milestones towards Objective five. The capacity building component of the SIMLESA program aims to increase the efficiency of agricultural research. The program focuses not only on short-term training but also long-term to build capacity amongst the present and future generation of agricultural scientists. The capacity building program intends to increase the understanding and knowledge of CA principles including pest and disease management as well as skills required for data management and analysis; and participating and managing Innovation Platforms.

The Agricultural Research Council (ARC), as one of the capacity building partners for the SIMLESA program, has more than 200 training courses across the agricultural value-chain. The courses are constantly being updated as new information becomes available. Training courses for SIMLESA scientists
and extension personnel were custom designed to accommodate the expressed needs of each country or group of trainees from different countries. For in-country training, ARC experts travel to those countries to conduct practical training. In-house training involves travelling of participants from different countries to ARC in South Africa. The interactive learning approach was the major style of learning utilized during the training, which has proved very effective.

**Capacity Building Workshops**

In the 3 years of the partnership between the ARC and the SIMLESA program, all target countries were visited and capacity building needs identified together with the country coordinators. A total of 93 scientist from 10 different countries were trained in the period July 2013 to March 2014.

**In-house Science Communication Training (3-8 March 2014)**

10 SIMLESA Scientists were invited to a Science Communication Workshop on the 3-8\textsuperscript{th} March 2014. The Science Communication workshop was hosted by Beastenough, a service provider of the ARC specializing in Science Communication, Public Understanding of Science, Video Production and Journalism. The focus of the workshop was to assist the Scientists produce a SIMLESA Kit, composed of 6 articles (according to SIMLESA’s 5 objectives), Video Clips, Policy Recommendation, and SIMLESA Magazine. The SIMLESA Kit was presented to the Annual General Meeting in Addis Ababa, Ethiopia on the 7\textsuperscript{th} April 2014. The SIMILESA Kit articles and details are attached as annexes.

**In-country training workshops**

These were held in Arusha (Tanzania) and Moshi (Tanzania). The focus of this training was on the Principles of CA, Pest & Disease Management, Biometry, Introduction to Innovation Platforms and Extension Principles. Long-term training and Introduction to Innovation Platforms were the most popular and requested training modules. This resulted in the development of a resource book that can assist facilitators and extension officers with skills to establish innovation platforms.

**Training in Tanzania (25-29 November 2013)**

The training in Tanzania (Moshi) had 55 participants and covered the following modules:

- **Statistical Guideline** module (1 day) was presented to the two groups. In general all participants find the course useful to very useful and 70% say it was clear to very clear. They would like this course to be repeated over a longer period with more practical examples. Data Analysis with Excel2010 (1.5 days) workshop was too short for all the participants and they requested that the workshop should be repeated for at least one week period. In general all participants find the course useful to very useful and 90% say it was clear to very clear.
Pivot table session in the Excel2010 workshop was presented on the 29th of November 2013. 62% of the participants found the course to be clear to very clear. The course was also regarded as useful by 75% of the participants. However 75% of the participants indicated that the time allocated for the course was too short and that the length of the course should be made longer.

Graphical presentation using Excel2010 workshop was presented on the 29th of November 2013. The workshop was attended by 26 participants. 87% of the participants said the aims of the workshop were made clear to them. Even though all participants (100%) found the workshop very useful and 96% were very satisfied with the trainer, more than 60% of the participants found the duration of the workshop too short. Due to the time allocated that was too short, all participants requested that the workshop repeated another time and for a longer period so that they can be confident in applying the knowledge applied to them.

Weed Management course was presented from the 26 – 27 November to 29 participants. Topics like weed biology, adjuvants, weed management and knapsack calibration were addressed during the two day course. 100% of the participants found it useful to very useful. The course was very interesting, particularly the calibration part which included a practical part which improved confidence levels.

Biometry Consultation Workshop (26-30 May 2014)

As part of the current Capacity Building contract between the ARC and CIMMYT, a request from the Programme coordinator was made to host a Biometry Consultation Week, in Harare. The aim of the Biometry Consultation week was to provide statistical services and editing of publications for 10 young scientists coming from Ethiopia, Kenya, Malawi and Zimbabwe. Ten data sets were sent 1 weeks prior travelling so that Biometricians could familiarise themselves with it. From 26 to 30th May 2014, 13 CIMMYT agronomy scientists (1 female and 12 males) gathered at Rainbow Towers hotel, Harare for a 5 day data handling and analysis workshop to consolidate SIMLESA’s Objective 2 results obtained in the last 4 years with a view to turn these into credible scientific publications.

Human Capital Development

One PhD candidate (Tanzania) is registered with the University of KwaZulu Natal (Frank Mmbano). Data collection in Tanzania was finalized in February 2014. Mr Mbano is expected to finalize his write up by June 2015.

Two MSc candidates (Mozambique) Gabriel Bragga and Custodia Jorge registered with the University of Free State. These students have since finalized their conducting field and glasshouse trials at the Grain Crops Institute (Potchefstroom campus). Analysis of data and compilation of their theses is expected to continue until December 2014.
Observations and lesions learnt
Participants are very grateful and participate enthusiastically in all activities, however, it’s clear that most of them are struggling with basic concepts especially in Biometry and therefore extended training has been requested.

The training provided always includes elements of extension methodologies; this is to assist the scientists, who are tasked with training extension, to be able to do so. The Training & Advisory Unit together with ICRA partners provided the additional training in the form of modules such as: Communication; Working in teams; Managing stakeholders; Facilitation skills (how to facilitate a workshop); Science Communication (for interacting with media). These are ARC in-house courses and some of them are accredited. The courses are designed specifically for scientists to be able to deal with the different clients and multi-disciplinary teams; to be able to face the media and engage meaningfully for the public understanding of the science they produce. Most important, these additional modules enable scientists source R&D needs from their users, in this case Extension and Farmers.
3 IMPACTS

3.1 Scientific Impact

The long term trials addresses issues such as methods to control termite infestation in CA, weed control methods in CA and different technological methods for implementing CA. The trials have been designed to gather data that is capable to be analyzed, reported and published in scientific journals. The exploratory trials although designed to be a simple demonstrations very easily understood by small-scale farmers they have the virtue to be statistically analyzed.

SIMLESA has embarked on an extensive experimentation program to assess the longer-term benefits of conservation agriculture (CA) compared to conventional tillage systems. There is an expectation that short-term yield benefit from water conservation will also accrue from CA systems in rainfed systems. To extrapolate and analyse these short-term effects on crop growth across seasons and sites, a tested and calibrated APSIM model is required.

Yield results from 6 on-station trials for up to 3 cropping seasons were presented and along with climate, soil and management data, used to evaluate APSIM’s performance in simulating the observed crop responses for CA and Conventional tillage systems. To assess the observed results, crop yields across sites were plotted against an environmental index (EI), calculated as the mean of all treatment yields in a season, at each site. In breeding, the EI is used to identify higher and lower yielding varieties relative to the EI benchmark.

![SIMLESA On-Station Maize Results](image1)

![SIMLESA On-Station Legume Results](image2)

Fig 1. Measured maize and legume yields in on-station trials, plotted against environmental yield index.
Long dry spells are a major hazard for crop production in rainfed systems and improved soil water capture (reduced runoff) and retention (reduced soil evaporation) is expected under CA systems where crop residues are retained on the soil surface. Nevertheless, crop benefits from water conservation in CA systems will vary with seasonal rainfall conditions and interact strongly with soil N supply. The dynamic nature of these interactions can make the task of interpreting experimental results difficult, but may be assisted by well tested crop simulation models, (See attached QAAFI report for details).

3.2 Capacity (PhD students; national planning workshops)

SIMLESA program managed to strengthen capacity of smallholder farmers in the use of innovative technologies which are friendly to climatic change. This has been achieved main through capacity building training of both NARS and farmers at country level as well as through long term formal education support. While the SIMLESA capacity development efforts covers a variety of areas, a greater part of these focuses on conservation agriculture principles and technologies; sustainable and climate smart agricultural productions systems; management of climate variability; socio-economic dynamics of households and modeling; agricultural production systems simulations; risk management and systems modelling.

Not only has the programme prioritised capacity development of researchers, extension practitioners and farmers, but it has also targeted young people for postgraduate training and mentorship. For example 22 doctoral students been enrolled at numerous universities across South Africa, Australia, Ethiopia and Kenya and a total of 42 Master of Science students at national universities within SIMLESA partner countries. The programme aims to create the capacity of young researchers in the areas of plant science and agricultural economics as an effort to build African national agricultural research and development capacity.

SIMLESA Capacity building components have included postgraduate training, short courses, field demonstration days, farmer exchange programmes, workshops, conferences and community theatre. These have been delivered through active partnerships with various reputable African and Australian partners such as the South African Agricultural Research Council (ARC), Queensland Alliance for Agriculture and Food Innovation (QAAFI), Murdoch University and the Association for Strengthening Agricultural Research in Eastern and Central Africa ASARECA. In addition to human capital building activities, SIMLESA also assisted national agricultural research institutions with physical capital assets such as vehicles, irrigation facilities, information technology and laboratory equipment to support research and agricultural development activities.
3.3 Community (Economic; social)

Results from most SIMLESA surveys showed that when farmers are more educated have better access to land. Or alternatively, the more land you have the better the access you have to education. Male headed households have better access to land compared to female ones. Generally farmers who participated in other activities such as extension has better yields - are better performers. This shows the importance of extension in farming. The better access you have to land and knowledge the better the yield. Land could be used as collateral to access credit or can be leased to other farmers and increase access to farming inputs. Again those who have more land can invest in sustainable long term activities as opposed to those who have it on lease who can’t access it in the long run. The richer farmers have better access to inputs and therefore can invest more in their land putting more fertilizer and hiring labour to do their operations and therefore are expected to harvest more than the poor farmers. Farmers who keep cattle can sell their livestock to access whatever inputs they need. They can also use livestock as collateral to access credit i.e. they are more creditworthy.

3.4 Communication and Dissemination Activities (meetings, workshops, Field days held)

Most fundamental methods within SIMLESA program in enhancing communication and dissemination activities are through meetings, workshops (training), field days and during program monitoring. The national field tour for Mozambique was carried out from the 23rd of February to 1st of March 2014. The main objectives of the field tour were to assess progress in the implementation of planned activities and to provide an opportunity for interaction between stakeholders in addressing challenges faced in the field by farmers. The tour involved key stakeholders of the project which involve farmers, implementation partners, research personnel, local leaders, extension officers and CIMMYT staff. A similar tour was conducted in Malawi in January 2014.

Seven districts visited in Mozambique during the field tour were Sussundenga Rotando, Sussundenga Muninga, ISPM Mastino, Marera, Makati, Manica and Nyamapanda. During the visit both on-station and on-farm long term exploratory trials were visited. In addition to that outscaling or adopters were also visited by the team in trying to assess adoptability and sustainability of the project since technology adopters are sourcing own inputs. An SMS system was established in Mozambique as a way of enhancing communication with farmers in the country.

In regard to communication and dissemination activities SIMLESA using various means and equipments which include TV documentaries, radio programs, field visits, seed show, farmer exchange visits, booklets and posters.
4 Training activities

ARC conducted numerous training activities as part of capacity building of partners during the reporting period as summarized below:

<table>
<thead>
<tr>
<th>MODULES</th>
<th>VENUE</th>
<th>COUNTRIES TRAINED</th>
<th># TRAINED</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>In House Training</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CA, Weed management, Pest &amp; disease management, Stats, Introduction to IP, soil nutrition management</td>
<td>Potchefstroom</td>
<td>Young scientist from Mozambique, Rwanda, Kenya, Malawi, Tanzania, Ethiopia, Uganda,</td>
<td>15</td>
</tr>
<tr>
<td>Science Communication Workshop: Personal Grooming, Dealing with Media, Writing Media Brief; Science Writing Tools; TV Interviews</td>
<td>Hatfield</td>
<td>CIMMYT Senior Scientists and Country Coordinators from: Ethiopia, Kenya, Malawi, Tanzania, Mozambique, Zimbabwe, Rwanda &amp; Uganda</td>
<td>10</td>
</tr>
<tr>
<td><strong>In Country training</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Statistical Guidelines; data analysis using EXEL and Weed Management</td>
<td>Moshi</td>
<td>Tanzania</td>
<td>55</td>
</tr>
<tr>
<td>Biometry Consultation</td>
<td>Rainbow Hotel</td>
<td>Harare</td>
<td>10</td>
</tr>
<tr>
<td><strong>Post Graduate Training</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PhD in Economics</td>
<td>University of KwaZulu Natal</td>
<td>Mr Frank Mmbano (Tanzania)</td>
<td>1</td>
</tr>
<tr>
<td>Masters in Agronomy</td>
<td>University of the Free State</td>
<td>Mr Costodio Jorge &amp; Gabriel Braga (Mozambique)</td>
<td>2</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td></td>
<td></td>
<td>93</td>
</tr>
</tbody>
</table>

As a result of capacity building through training, a SIMLESA Kit was prepared during science communication workshop in Pretoria. The kit was presented to the Annual General Meeting in Addis Ababa, Ethiopia on the 7th April 2014, composed of the following:

**SIMLESA Magazine 2010-2014**

**Article 1**: Bridging the gender gap within SIMLESA countries

**Article 2**: Farmer-preferred maize varieties released to enhance food security in Eastern and South Africa

**Article 3**: Legumes for Food, Nutrition, Income Security in ESA

**Article 4**: Conservation Agriculture Technologies help increase yields and save on labour costs
Article 5: SIMLESA technologies spill over to other countries

Article 6: SIMLESA Improving Africa’s Capacity for Sustainable Agricultural Development and Food and Nutrition Security

Article 7: Nurturing Innovation Platforms and empowering smallholder farmers

Article 8: Policy Brief: Sustainable Agricultural Intensification Through Multi-technology Adoption: A Regional Overview from East and Southern Africa

SIMLESA Video Clips

ARARECA managed to facilitate a number of capacity training to SIMLESA partner countries specifically on gender mainstreaming and programme monitoring and evaluation. The trainings they conducted include:

- Gender mainstreaming
- Introduction to M&E Principles
- Performance Monitoring Plans (PMP) and Measurement Frameworks (PMF)
- Managing for Development Results (Results-Based Management)
- Data Quality Assessment & Management
- Measurement of Qualitative Indicators
- Introduction to Impact Evaluation.
5 Variations to future activities

The initial phase of SIMLESA which started in 2010 ended on the 31st of June 2014 which was surpassed by SIMLESA 2. Its background is mainly based on four main rudiments; SIMLESA-1 collective experience, 3rd Annual Review and Planning Meeting (ARPM), Mid-term Review (MTR) and Project Steering Committee (PSC).

The overall objective of the second phase of SIMLESA is a continuation of the original 10-year vision by the year 2023:

- to sustainably improve maize & legume productivity of selected maize-based farming systems in each target country by 30% from the 2009 average
- to reduce the expected downside yield risk by 30%
- on approximately an additional 650,000 farms

SIMLESA 2 Objectives

6. to enhance the understanding of CA-based sustainable intensification for maize-legume production systems, value chains and impact pathways;

7. to test and adapt productive, resilient and scalable CA-based intensification options for sustainable smallholder maize-legume production systems;

8. to increase the range of maize, legume and fodder/forage varieties available to smallholder farmers;

9. to support and develop local and regional innovation systems and scaling-out modalities;

10. capacity building to increase the efficiency of agricultural research today and in the future

The main elements of the projects are a combination of agricultural innovations to increase productivity & profitability, reduce downside production risks, enhance sustainability and strengthen innovation platforms/systems. All these projects aspects were derived from SIMLESA 1 achievements:

- characterization of maize-legume production and value chain systems;
- testing of promising smallholder maize-legume cropping systems;
- increasing the range of maize and legume varieties available for smallholders;
- developing regional and local innovations systems; and
- Substantial capacity building of agricultural research partners.

Based on lessons learnt SIMLESA-2 is mainly focusing on broader technological focus (core thrust: Conservation Agriculture (CA)-based sustainable intensification), System orientation (from plot to farm), Impact orientation (Adoption, impact pathways, value chain linkages), Partnership in scaling up/out technology and competitive grants. Additional two research areas for the second phase of SIMLESA are:

i. Biomass management research
– residue scarcities & fodder/forage production in mixed crop-livestock systems (Ethiopia, Kenya, Tanzania)

ii. Soil health research

– Nutrient (nitrogen) dynamics and management
– identification and rehabilitation of non-responsive soils
4. Variation to personnel

During the reporting period there are no major changes. List of SIMLESA 2 program personnel are listed in annex1 attached:
6 Problems and opportunities

Challenges

Erratic rains and the overall effect of climatic change is one of the main problems being experienced in all countries. Marketing seems to be a challenge in all operational countries, both input and output markets. Establishment and strengthening of local innovative platforms will go a long way in resolving marketing challenges. In Malawi it was discovered that most seed companies involved in seed multiplication programs have little experience in seed production hence they required constant backstopping by the department of agricultural research services (DARS) as well as capacity building trainings. Lack of irrigation facilities for most seed companies negatively affects seed production levels.

Opportunities

In all SIMLESA operational countries it was noted that farmers, key stakeholders and members of the community are ready to work and scale out the project technologies. Participatory methodologies used in the selection process of the best bet technologies empowered the communities and it divulged sense of ownership. Farmer’s effort is also being complemented by the established local innovation platforms. This will enable effective transfer of SIMLESA technologies to many farmers in a sustainable manner.
7 Budget

HQ to provide financial report
ANNEX 1: VARIATIONS TO PERSONNEL

List of participants involved in the program

CIMMYT as Commissioned Organization leads and coordinates the overall program through the Program Coordinator, who is supported by the CIMMYT financial, administrative and legal services and Program Management Committee. Two line Directors for Agronomy and Economics collectively provide oversight for program implementation and individually of their respective disciplinary areas. Each Collaborating Organization will progressively adjust the disciplinary composition of its research team to reflect the overall disciplinary balance and priorities of the program, and will manage the research team and other partner/contractor activities through a Partner Coordinator.

<table>
<thead>
<tr>
<th>No</th>
<th>Name</th>
<th>Sex</th>
<th>Agency, position (location)</th>
<th>Role in program (discipline)</th>
<th>Time input (%)</th>
<th>Funding</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Mulugetta Mekuria</td>
<td>m</td>
<td>CIMMYT, Senior Scientist (Zimbabwe-based)</td>
<td>Program Coordinator, overall leadership of the program</td>
<td>100</td>
<td>ACIAR</td>
</tr>
<tr>
<td>2</td>
<td>Bruno Gerard</td>
<td>m</td>
<td>CIMMYT, Director GCAP (Mexico-based)</td>
<td>Oversight agronomy research quality, member PMC (Systems Agronomist, incl crop-livestock systems)</td>
<td>5</td>
<td>ACIAR</td>
</tr>
<tr>
<td>3</td>
<td>Olaf Erenstein</td>
<td>m</td>
<td>CIMMYT, Director SEP (Ethiopia-based)</td>
<td>Oversight of socioeconomic research quality, PMC chair (Agricultural Economist incl crop-livestock systems)</td>
<td>10</td>
<td>ACIAR</td>
</tr>
<tr>
<td>4</td>
<td>Peter Craufurd</td>
<td>m</td>
<td>CIMMYT, ESA Agronomy Leader GCAP (Kenya-based)</td>
<td>Strategic Research Team Leader, East &amp; Southern Africa (Systems Agronomist)</td>
<td>15</td>
<td>ACIAR</td>
</tr>
<tr>
<td>5</td>
<td>Vongai Kandiwa</td>
<td>f</td>
<td>CIMMYT, Associate Scientist (Kenya-based)</td>
<td>Gender specialist (gender studies)</td>
<td>50</td>
<td>ACIAR</td>
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<tr>
<td>6</td>
<td>Menale Kassie</td>
<td>m</td>
<td>CIMMYT, Scientist (Kenya-based)</td>
<td>Analysis of markets and value chains; adoption and impacts (Agricultural &amp; market economist)</td>
<td>35</td>
<td>ACIAR</td>
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<tr>
<td>7</td>
<td>Moti Jaleta</td>
<td>m</td>
<td>CIMMYT, Associate Scientist (Ethiopia-based)</td>
<td>Analysis of markets and value chains (Agricultural &amp; market economist incl crop-livestock systems)</td>
<td>35</td>
<td>ACIAR</td>
</tr>
<tr>
<td>8</td>
<td>Fred Kanampiu</td>
<td>m</td>
<td>CIMMYT, Senior Scientist (Kenya-based)</td>
<td>Agronomic research eastern Africa (Agronomist)</td>
<td>67</td>
<td>ACIAR</td>
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<tr>
<td>9</td>
<td>Paswel Marenya</td>
<td>m</td>
<td>CIMMYT, Scientist (Ethiopia-based)</td>
<td>Policy economist, eastern Africa</td>
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<td>ACIAR</td>
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<tr>
<td>10</td>
<td>Isaiah Nyagumbo</td>
<td>m</td>
<td>CIMMYT, Scientist (Zimbabwe-based)</td>
<td>Agronomic research southern Africa (Agronomist)</td>
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<td>ACIAR</td>
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<tr>
<td>11</td>
<td>Dagne Wegary</td>
<td>m</td>
<td>CIMMYT, Associate Scientist (Ethiopia-based)</td>
<td>Seed systems and support/ facilitation of expansion program (Breeder)</td>
<td>25</td>
<td>ACIAR</td>
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<tr>
<td>12</td>
<td>Munyarakz Mutenje</td>
<td>f</td>
<td>CIMMYT, Post doc Scientist (Zimbabwe-based)</td>
<td>Socio-economist, southern Africa</td>
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<td>13</td>
<td>Peter Setimela</td>
<td>m</td>
<td>CIMMYT, Senior scientist (Zimbabwe-based)</td>
<td>Seed systems (Breeder)</td>
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<td>No</td>
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<td>Role in program (discipline)</td>
<td>Time input (%)</td>
<td>Funding</td>
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<td>14</td>
<td>Michael Misiko</td>
<td>m</td>
<td>CIMMYT, Scientist (Ethiopia-based)</td>
<td>Innovation systems, eastern Africa (Agricultural Anthropologist)</td>
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<tr>
<td>15</td>
<td>Jens Andersson</td>
<td>m</td>
<td>CIMMYT, Senior Scientist (Zimbabwe-based)</td>
<td>Innovation systems, southern Africa (Rural Development Sociologist)</td>
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<td>ACIAR</td>
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<tr>
<td>16</td>
<td>Haekoo Kim</td>
<td>m</td>
<td>CIMMYT, Postdoc Scientist (Ethiopia-based)</td>
<td>Agronomic research eastern Africa (Farming systems agronomist)</td>
<td>67</td>
<td>ACIAR</td>
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<tr>
<td>17</td>
<td>Frederic Baudron</td>
<td>m</td>
<td>CIMMYT, Scientist (Ethiopia-based)</td>
<td>Systems agronomy (Agronomist incl crop-livestock systems)</td>
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<tr>
<td>18</td>
<td>Dil Rahut</td>
<td>m</td>
<td>CIMMYT, Scientist (Ethiopia-based)</td>
<td>Program oversight (Agricultural economist)</td>
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<td>ACIAR</td>
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<tr>
<td>19</td>
<td>David Kahan</td>
<td>m</td>
<td>CIMMYT, Principal scientist (Ethiopia-based)</td>
<td>Agri-business development specialist</td>
<td>45</td>
<td>ACIAR</td>
</tr>
<tr>
<td>20</td>
<td>M&amp;E specialist (to be recruited)</td>
<td></td>
<td>CIMMYT (to be Zimbabwe-based)</td>
<td>M&amp;E specialist</td>
<td>100</td>
<td>ACIAR</td>
</tr>
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</table>

**Partner Australian institution – QAAFI**

<table>
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<th>No</th>
<th>Name</th>
<th>Sex (m/f)</th>
<th>Agency, position (location)</th>
<th>Role in program (discipline)</th>
<th>Time input (%)</th>
<th>Funding</th>
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<tbody>
<tr>
<td>1</td>
<td>Daniel Rodriguez</td>
<td>m</td>
<td>QAAFI, Senior Research Fellow (Harare and Australia)</td>
<td>Partner Coordinator, Systems modelling (Crop Eco-physiologist)</td>
<td>40</td>
<td>QAAFI</td>
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<tr>
<td>2</td>
<td>Andries Potgieter</td>
<td>m</td>
<td>QAAFI, Research Fellow</td>
<td>GIS &amp; regional production modeling (GIS)</td>
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<tr>
<td>3</td>
<td>John Dimes</td>
<td>m</td>
<td>QAAFI, Senior Research Fellow (Addis Ababa and Australia)</td>
<td>Field research agronomy (Agronomist-soil scientist)</td>
<td>contrac-tual</td>
<td>ACIAR</td>
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<tr>
<td>4</td>
<td>Joseph Eyre</td>
<td>m</td>
<td>QAAFI, Research Fellow (Harare and Australia)</td>
<td>Research Fellow (B3 Level) (Crop eco-physiology / agronomy)</td>
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<td>ACIAR</td>
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<tr>
<td>5</td>
<td>TBA (Stuart I Brown?)</td>
<td>m</td>
<td>QAAFI, Research Fellow (Addis Ababa and Australia)</td>
<td>Research Fellow (B1 Level) (Soil sciences / agronomy)</td>
<td>100</td>
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<tr>
<td>6</td>
<td>Peter Davis</td>
<td>m</td>
<td>DAFFQ, Research Scientist</td>
<td>GIS regional production modeling (GIS)</td>
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<tr>
<td>7</td>
<td>Peter deVoil</td>
<td>m</td>
<td>DAFFQ Senior Research Scientist</td>
<td>Modelling support</td>
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<tr>
<td>8</td>
<td>Brendan Power</td>
<td>m</td>
<td>DAFFQ Senior Research Scientist</td>
<td>Data mining</td>
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<td>ACIAR</td>
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<tr>
<td>9</td>
<td>Caspar Roxburgh</td>
<td>m</td>
<td>QAAFI, PhD candidate</td>
<td>PhD Candidate</td>
<td>100</td>
<td>QAAFI</td>
</tr>
<tr>
<td>10</td>
<td>James McLean</td>
<td>m</td>
<td>QAAFI, Senior Technical Officer</td>
<td>Field Agronomy (research activities in Australia)</td>
<td>100</td>
<td>ACIAR</td>
</tr>
</tbody>
</table>

As complementary input with additional Australian funding, QAAFI will also incorporate a new soils specialist, Caspar Roxburgh, an Australian PhD student that will work on the nitrogen dynamics in soils of low (Africa)
and high (Australia) Nitrogen input systems. He is envisaged to have trials in Africa and in Australia. He has an Australian Post-graduate Scholarship and is enrolled with QAAFI.

**Partner country institution - Ethiopia**

<table>
<thead>
<tr>
<th>No</th>
<th>Name</th>
<th>Sex (m/f)</th>
<th>Agency, position (location)</th>
<th>Role in program (discipline)</th>
<th>Time input (%)</th>
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<tr>
<td>1</td>
<td>Tadesse Birhanu Atomsa</td>
<td>m</td>
<td>Bako Research Center</td>
<td>Agronomist, Site Coordinator</td>
<td>30</td>
<td>OARI</td>
</tr>
<tr>
<td>2</td>
<td>Gezahegn Bogale Gebre</td>
<td>m</td>
<td>EIAR Senior Researcher, Melkassa RC (Melkassa)</td>
<td>Maize breeding (Breeder)</td>
<td>35</td>
<td>EIAR</td>
</tr>
<tr>
<td>3</td>
<td>Mekonnen Sime Kidane</td>
<td>m</td>
<td>EIAR, Researcher Melkassa RC (Melkassa)</td>
<td>Partner Coordinator, Extension and Rural Development</td>
<td>50</td>
<td>EIAR</td>
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<tr>
<td>4</td>
<td>Adam Bekele</td>
<td>m</td>
<td>EIAR, Researcher Melkassa RC (Melkassa)</td>
<td>Agric Economist Socio economics coordinator</td>
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<td>EIAR</td>
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<tr>
<td>5</td>
<td>Feyera Merga Liben</td>
<td>M</td>
<td>EIAR, Researcher, Melkassa RC (Melkassa)</td>
<td>Agronomy coordinator</td>
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<td>EIAR</td>
</tr>
<tr>
<td>6</td>
<td>Asheber Tegegn</td>
<td>M</td>
<td>EIAR, Researcher Melkassa RC (Melkassa)</td>
<td>Animal production and rangeland Mgt</td>
<td>25</td>
<td>EIAR</td>
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<tr>
<td>7</td>
<td>Goshime Muluneh Mekasha</td>
<td>m</td>
<td>EIAR Researcher, Awassa RC (Awassa)</td>
<td>Maize breeding (Breeder)</td>
<td>40</td>
<td>EIAR</td>
</tr>
<tr>
<td>8</td>
<td>Solomon Jemal Hassan</td>
<td>m</td>
<td>EIAR, Senior Researcher, (Addis Ababa)</td>
<td>Agronomist</td>
<td>20</td>
<td>EIAR</td>
</tr>
<tr>
<td>9</td>
<td>Getnet Assefa Tadeg</td>
<td>m</td>
<td>EIAR, Director Animal science (Addis Ababa)</td>
<td>Forage/ fodder crops evaluation (Animal production and forage specialist)</td>
<td>20</td>
<td>EIAR</td>
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</tbody>
</table>

**Partner country institution – Kenya**

<table>
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<tr>
<th>No</th>
<th>Name</th>
<th>Sex (m/f)</th>
<th>Agency, position (location)</th>
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<th>Time input (%)</th>
<th>Funding</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Charles Nkonge</td>
<td>m</td>
<td>KARI, Senior Research Officer (Nairobi)</td>
<td>Partner Coordinator, Food Technology</td>
<td>50</td>
<td>KARI</td>
</tr>
<tr>
<td>2</td>
<td>Martins Odendo</td>
<td>m</td>
<td>KARI, Senior Research Officer &amp; Coordinator, Head Socioeconomics Section (Kakamega)</td>
<td>Socioeconomics (Economist)</td>
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<td>KARI</td>
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<tr>
<td>3</td>
<td>Vincent Woyengo</td>
<td>m</td>
<td>KARI, Senior Research Officer (Kakamega)</td>
<td>Seed systems (breeder)</td>
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<td>KARI</td>
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<tr>
<td>4</td>
<td>Christine Ndingya- Omboko</td>
<td>f</td>
<td>KARI, Technical Officer, Head of Seed Program (Kakamega)</td>
<td>Seed Science (Agriculturist)</td>
<td>30</td>
<td>KARI</td>
</tr>
<tr>
<td>5</td>
<td>Ezekiah Ngoroi</td>
<td>m</td>
<td>KARI, Agronomist (Embu)</td>
<td>Seed Science (Agriculturist)</td>
<td>30</td>
<td>KARI</td>
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<tr>
<td>No</td>
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<td>Time input (%)</td>
<td>Funding</td>
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<td>Alfred Ngera Micheni</td>
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<td>KARI, Assistant Head of SWM &amp; Adaptive Research (Embu)</td>
<td>Site coordinator, Agronomy (Agronomist)</td>
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<td>George Agaya</td>
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<tr>
<td>2</td>
<td>Kelvin Dambuleni</td>
<td>m</td>
<td>DARS Agric. Economist/ Socioeconomist, Chitedze RC</td>
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<tr>
<td>3</td>
<td>Kesbell Kaswela Eston Kaonga</td>
<td>m</td>
<td>DARS Principal Maize Breeder and Maize Commodity Team Leader, Chitedze RC</td>
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<td>4</td>
<td>Jastus Chintu</td>
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<tr>
<td>5</td>
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<td>Esnart Yohane</td>
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<td>Kenneth Chaula</td>
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<tr>
<td>9</td>
<td>Donwell Kamalongo</td>
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**Partner country institution – Malawi**

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<td>1</td>
<td>Angela Machinji</td>
<td>f</td>
<td>ISPM, director business incubator centre (Manica)</td>
<td>Gender and M&amp;E Focal Person</td>
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<td>2</td>
<td>Pedro Fato</td>
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<td>3</td>
<td>AmancioNhantumbo</td>
<td>m</td>
<td>IIAM-Northeast Region, (Nampula)</td>
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<tr>
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<td>Maria Quinhentos</td>
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<td>Isabel Cachomba</td>
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<td>IIAM, Research assistant (Maputo)</td>
<td>(Economist)</td>
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<tr>
<td>6</td>
<td>Domingos José Brás Dias</td>
<td>m</td>
<td>IIAM, Head, Research Dept, Central Zonal Center (Chimoio)</td>
<td>Agronomy research, partner coordinator (Agronomist)</td>
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<td>Manuel Amane</td>
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<td>8</td>
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**Partner country institution – Tanzania**

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<tr>
<td>1</td>
<td>Lucas Mugendi</td>
<td>m</td>
<td>ARS, Agric. Res. Officer, Selian ARI (Arusha, Northern Zone)</td>
<td>Tanzania, Partner Coordinator, Legume agronomist</td>
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<td>2</td>
<td>Ruth Madulu</td>
<td>F</td>
<td>ARS, Agric. Res. Officer, ARI-Ilonga (Ilonga, Eastern Zone)</td>
<td>Farming Systems &amp; Socio-economics analysis (Economist)</td>
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<td>4</td>
<td>Barshir Makoko</td>
<td>M</td>
<td>Scientist, Eastern Zone, Agric Research Inst, Ilonga, Eastern Zone, Kilosa</td>
<td>Site coordinator, Maize agronomy research (Agronomist)</td>
<td>50</td>
<td>DRD</td>
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<tr>
<td>5</td>
<td>John Sariah</td>
<td>m</td>
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<td>Site coordinator, Maize agronomy research (Agronomist)</td>
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<td>6</td>
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<td>Theresia Gregory</td>
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<td>Phillmon Mushi</td>
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<td>Shadrack Mbabila</td>
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Collaborators have sent support and endorsement of the program as follows:

<table>
<thead>
<tr>
<th>Partner Institution</th>
<th>Official Endorsing the Proposal</th>
<th>Date of endorsement</th>
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<tbody>
<tr>
<td>Malawi, DARS</td>
<td>Dr Alfred Mutukuso, Director, Dept of Agricultural Research Services Ministry of Agriculture and Food Security, Malawi</td>
<td>18-09-2013</td>
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<tr>
<td>Mozambique, IIAM</td>
<td>Dr. Inacio Maposse, Director General, IIAM</td>
<td>17-09-2013</td>
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<tr>
<td>Ethiopia, EIAR</td>
<td>Dr. Fentahun Mengistu, Director General, EIAR</td>
<td>19-09-2013</td>
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<td>Tanzania, DRD</td>
<td>Dr. Fidelis Myaka, Director, Research and Development</td>
<td>19-09-2013</td>
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<tr>
<td>Kenya, KARI</td>
<td>Dr. Ephraim Mukisira Director</td>
<td>19-09-2013</td>
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<tr>
<td>CIMMYT</td>
<td>Dr Maria Luz George, Head Project Management Unit</td>
<td>18-09-2013</td>
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<tr>
<td>QAAFI</td>
<td>Robert Henry, Professor of Innovation in Agriculture, Director of QAAFI</td>
<td>4-07-2013</td>
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ANNEX 2: ASARECA REPORT

SIMLESA Project Annual Report (July 2013-June 2014) from ASARECA

1. Progress summary

This is a consolidated progress report for Objective 4, which comprises technical backstopping on: gender mainstreaming, monitoring and evaluation frameworks, and knowledge transfers and spillovers. It is for the period is for 2013/2014.

During this period, the gender Mainstreaming Unit (GMU) contributed to SIMLESA project activities by providing technical backstopping in gender mainstreaming. This is to support the overall program objective of ensuring the integration of gender aspects in the different activities of SIMLESA. During the year, M&E provided the backstopping inputs through conducting tailor-made training and periodic updating of the master program performance monitoring plan (PMP) and performance measurement framework (PMF) and participating in the program meetings. Under knowledge transfer, the main activity was finalizing the synthesis and publication of the output of the study on inventory of available SIMLESA technologies (Maize, Legume and CA), dissemination methods and conditions for facilitating knowledge & technology transfers and spillovers. The publications were disseminated at the 4th ARPM held in Addis Ababa in April 2014.

The following are the detailed activities were carried out under the three components during the reporting period.

4.1. Gender mainstreaming

1. Capacity building

Experience from the field and different observations demonstrate that there is a need for additional and continues capacity building on understanding of gender the relevance of gender mainstreaming in agricultural research for development and its application in real life. Therefore, financial assistance and technical backstopping was provided to undertake gender training in participating countries. The amount of 5000 USD each was transferred to Ethiopia, Malawi, Mozambique and Tanzania based on their action plan. Kenya, was not included as part to transfer the money due to differences in agreement of accepting some of the statements in the sub-grant agreement. The report obtained from Malawi, Mozambique and Ethiopia are summarized and presented in the following table.
<table>
<thead>
<tr>
<th>Country</th>
<th>Ethiopia</th>
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<th>Mozambique</th>
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<td>Community Level Gender Analysis Capacity Building for SIMLESA Ethiopia program staff</td>
<td>Gender Mainstreaming in Agricultural projects</td>
<td>Gender mainstreaming training workshop</td>
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<td>Men</td>
<td>Women</td>
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<tr>
<td></td>
<td>2</td>
<td>23</td>
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</table>
| Topics covered | • Overview of SIMLESA program in Ethiopia and gender dimensions in the project  
• Prospect and issue of gender in maize-legume production system and value chain  
• Gender responsive situation analysis to identify needs and proprieties that include sampling procedure and variables such as proper farmers’ representation in terms of resource ownership, level of education, access to information on agricultural technologies, level of participation in different research activities such as Participatory Variety Selection, demonstration, field days/exchange visits, technology scaling out, etc.)  
• Collection, analysis, and interpretation of gender disaggregated data: tools and application | • Overview of SIMLESA project  
• Introduction to gender and HIV in agriculture  
• Introduction to gender analysis – HAF  
• Gender responsive tools  
• Gender and HIV mainstreaming in agriculture  
• Gender responsive reporting | • Common understanding of gender concepts and tools  
• Understanding the relationship between gender, extension and rural development  
• Basic skills in applying gender analysis tools for field activities  
• Drafting Simple gender action plan for extension agents working with SIMLESA. | • Build participant’s capacity on the use of the Gender Analysis tools for field activities  
• Better understanding of Gender Mainstreaming knowledge and its application in their ongoing activities  
• Improve ability of transferring knowledge and skill on gender analysis |
Summary
Training report was obtained from three SIMLESA member countries Ethiopia, Malawi, Mozambique and Tanzania. The procedure was nearly similar in all the training processes. The approach used by the Ethiopia and Mozambique group promotes gender disaggregated field data to be used as a major guide for project appraisal and its implementation. The approach used by both groups is regarded as pertinent and applicable attempt to ensure full integration of gender in programme/project activities of SIMLESA. The major recommendations drawn from the report needs to be further designed and shared with other SIMLESA group. Summary of the recommendation indicated as follows.

- Understand and recognize household dynamics, their resource base and its management practices for project appraisal and implementation
- Focus on factors influencing demand as related to values, norms and economic reasons for choosing technologies
- Recognize differences between women's and men's resource and time allocation
- Establish a system for gender responsive monitoring and evaluation
- Identify priority needs and initiate SIMLESA activities specific to women and youth economic empowerment
- Focus on designing a strategy on how to engage the youth in SIMLESA activities
- Encourage and design the use of gender disaggregated data and promote gender responsive reporting for project design, monitoring, evaluation and learning

2. Validation of case study findings
In September 2013, The GMU has organized a meeting to validate case study report on “good practices and lessons learnt in gender mainstreaming initiatives of SIMLESA”. SIMLESA country representatives and SIMLESA country gender focal persons have participated from all member countries Kenya, Ethiopia, Malawi, Mozambique and Tanzania. The case study report was presented and discussed. Reflections from participants were captured to enrich the document and country representatives were requested to provide additional input where it was appropriate. The case studies brought out a range of issues that needs a follow up as a lesson for future research design.

3. Review workshop conducted
SIMLESA gender mainstreaming review workshop held on 23rd March, 2014 with members countries. Progress, and challenges were discussed and information was summarized to indicate in achievement and challenges.

4. Policy Brief developed
Draft Policy brief was developed to indicate the contribution and its effectiveness of gender mainstreaming in SIMLESA activities. The draft policy brief is shared among partners and is work on progress for final publication

5. Attended Annual review meeting (April 7 – 11, 2014)
ASARECA attended the Annual Regional Review, Planning and Program Steering Committee meeting for the Sustainable intensification of maize-legume cropping systems for food security in Eastern and southern Africa (SIMLESA) which was held 7 – 11 April, 2014. Challenges and recommendations under the different objectives were discussed for future consideration in Phase II. It is suggested that the gender mainstreaming activities should be part of the project designing for its effective implementation. An exhibition was also hosted and publications and information generated from the project shared with other scientists. An award was obtained for efforts made on integrating gender in the SIMLESA activities
4.2. Monitoring and Evaluation

1. **Capacity strengthening.** ASARECA M&E Unit conducted tailor-made trainings in M&E for selected SIMLESA implementers from all the 5 countries. A total of 19 people (14 males; 5 females) benefited from assorted M&E themes, especially:
   - Introduction to M&E Principles
   - Performance Monitoring Plans (PMP) and Measurement Frameworks (PMF)
   - Managing for Development Results (Results-Based Management)
   - Data Quality Assessment & Management
   - Measurement of Qualitative Indicators
   - Introduction to Impact Evaluation.

   Among the key impacts of these review workshops include:
   - Created a platform for joint updates of the country as well as ASARECA Master PMP
   - Equipped the implementers with practical skills to undertake field qualitative data collection, analysis and report writing
   - Endowed all the country M&E Officers and other implementers with advanced practical skills to undertake data quality assessment and management; and
   - Charted a very clear roadmap of the future SIMLESA M&E agenda.

2. **Technical support:** A series of M&E backstopping engagements with SIMLESA implementing teams were conducted. For instance, 2 M&E review meetings were convened by ASARECA M&E Unit. One was held in October 2013, while the other in March 2014. During the review meetings, key challenges were documented, action points were developed, and strategies for addressing them implemented. Other forms of engagement were through face-to-face discussions, email and phone calls.

3. **PMP Updates:** The M&E Unit has also periodically updated the SIMLESA Master Performance Monitoring Plans (PMP) and the Performance Framework (PMF). This Master PMP summarizes the data from the country-based PMPs, and provides up-to-date data on SIMLESA’s performance against annual targets. It has also been used to develop action plans to address areas with gaps (based on performance against indicator targets).

4. **Annual Regional Planning & Programme Steering Committee Meeting.** ASARECA’s team participated in the Annual Regional Planning meeting in Addis Ababa, Ethiopia in April 2014. In this meeting, the progress and achievements of SIMLESA were presented. These included summary of activities, including an M&E report that highlighted the project performance against milestones and indicators in the results framework.
5. **Process Evaluation.** In readiness for the end-of-Phase-I Evaluation of SIMLESA, the ASARECA M&E Unit convened a 3-day regional review meeting in Nairobi. During this workshop (attended by 17 people – 14 male; 3 female), performance against targets, including outcome- and impact-level indicators was assessed. As part of fast tracking delivery of expected results, ASARCA disbursed US$ 5,000 to each of the five SIMLESA-implementing countries to enable them undertake specific tasks. As a result of this, the following achievements have been noted:

- Data collection of the specific project activities were undertaken in the field by the researchers and other project implementers, especially meeting with key stakeholders, including farmers, opinion leaders, as well as conducting focus group discussions. During these meetings with stakeholders, project progress was jointly reviewed and areas needing immediate action spelt out.
- Conducted Process Evaluation in the field to verify some of the data already collected. This activity involved critical assessment and analysis of the processes and interventions undertaken by the scientists based on already agreed principles and operating procedures.

**Achievement against outputs/milestones**

**M&E Review workshop:** Among other roles, ASARECA oversees the Monitoring and Evaluation function of the SIMLESA program. As such, the M&E unit of ASARECA convened and facilitated two workshops, one in August 2013, (attended by 14 people – 11 male; 3 female) and the other in March 2014 (attended by 17 people – 13 male; 4 female). During the workshops, performance against targets, including outcome- and impact-level indicators was assessed. The workshops were attended by Country M&E focal persons, some Objective leaders and National Country Coordinators from the five SIMLESA participating countries, viz. Mozambique, Malawi, Tanzania, Kenya and Ethiopia. The second workshop was not only a buildup on the previously held M&E workshops, but one that was organized in preparation for the SIMLESA end-of-phase-1 Evaluation. Through these workshops, the SIMLESA program achieved the following:

- Jointly updated the country as well as SIMLESA Master Performance Monitoring Plan (PMP);
- Equipped the implementers with practical skills to undertake field qualitative data collection, analysis and report writing;
- Endowed the M&E Officers and other implementers with advanced practical skills to undertake data quality assessment and management; and charted a very clear roadmap of the future SIMLESA M&E agenda.

**Annual Review and Planning meetings held in April 2014:** The ASARECA M&E unit participated in the Annual Review and Planning meeting in Addis Ababa, Ethiopia. The purpose of the AR&P meeting was to assess the progress and performance of SIMLESA as well as jointly plan for the next phase of implementation. The meeting brought together all national and regional program teams, and provided a platform to share and understand the implementation direction of the program in every country. ASARECA M&E unit played its role of consolidating and presenting the SIMLESA performance report based on all the Key Performance Indicators in the program’s Results Framework.
Lessons and recommendation for the next phase

- Baseline surveys and development of PMP should be done before project implementation
- More resources should be allocated for M&E activities
- The indicators seemed to have been many (45), preferably these indicators could be reduced
- Data quality management should go beyond checking/verifying the data collected, but also incorporate aspects to do with sharing and storage of data
- Counterfactuals should be used in communities to measure impact attributable to SIMLESA
- SIMLESA team should use M&E data as a source of information during decision making
- Data collection should go beyond collection of sex disaggregated, to include gender disaggregated data
- Develop common data collection tools to cater for indicators that are difficult to validate
- There is need to provide feedback to various stakeholders after data collection and generation of reports
- M&E officers can use key stakeholders as a source of data, this would greatly reduce on the cost of data collection.

4.2. Knowledge Transfers and Spillovers

The synthesis and publication of output from the spillover study was completed during this period. The objectives of the study were (i) conduct spillover analysis to document past experiences and bottlenecks in formal and informal transfer of technologies, practices and knowledge products from project countries to non-project countries; (ii) identify the policy, institutional and biophysical conditions that enable smooth exchange; (iii) inventory of the available technologies, practices and knowledge products that are transferable from project countries to other relevant countries. The publication is available in two volumes: Vol1 is the main report. It documents the available technologies for maize, legumes and conservation agriculture practices; knowledge products and dissemination practices across the five SIMLESA countries; results of the analysis of factors that enable or constrain scaling out and spillovers, and provides sets of recommendations. It also contains several case studies of successful scaling out of the SIMLESA technologies. In Vol 2 contains the annexes, which include findings from the desk review and field notes from the country field work. The publications are posted on the ASARECA website for wider dissemination and use.

Challenges encountered during the period

Major challenges and issues emphasized in the policy brief

- It necessary to create critical mass through capacity building to address problems related to few gender specialists among agricultural researchers, and project implementers.
- Research quality and impact will improve when depend on the feed back of sex and gender disaggregated data from the field.
- Designing innovations that can engage the youth and empowerment of women will contribute to improved productivity
- There was no gender mainstreaming training for Kenya, because the funds could not be disbursed due to the gap in signing the sub-grant agreement.
- Clarity on procedure of gender integration and gender mainstreaming and its application as related to tools for the field, statistical gender disaggregated data analysis, interpretation and reporting for action

**Variations on future activities**

**Variations to future activities**

The following M&E activities have been planned

During the end-of-phase-1 Evaluation, ASARECA’s M&E unit will provide the necessary information, support and guidance the will be deemed necessary for the success for the exercise.

The unit will also provide M&E reports, updated SIMLESA PMP and reports from various M&E activities. In case of any face-to-face interviews or any questions or areas that need clarification from ASARECA, the unit will be in position to respond accordingly.

**Supporting materials**

The following documents are available as an evidence of achievement for the period July 2013- to December 2013.

1. A comprehensive SIMLESA case study report of the good practices.
2. Gender mainstreaming training reports of Mozambique
3. Gender mainstreaming training report of Malawi and
5. Gender training report of Tanzania
6. Draft Gender mainstreaming Policy Brief No.1 (Gender Mainstreaming for Food Security: Good Practices, Outcomes and Recommendations from SIMLESA Project)
7. Agricultural Knowledge and technology transfer & spillovers: Study to inform SIMLESA. Vol 1 and Vol2.
ANNEX 3: QAAFI REPORT

QAAFI - Annual Report 2013/14

Daniel Rodriguez, Andries Potgieter, James Mclean, Joe Eyre, John Dimes (QAAFI)

Progress summary

QAAFI participation during the fifth year of SIMLESA involved research and development activities across four of the five research objectives:

SIMLESA Objective 1
- Options for summer cropping intensification were re-evaluated prior in preparation for Phase II. An industry wide survey and workshop identified research priorities for sorghum, wheat and maize in Queensland (See activity 1.2.4).

SIMLESA Objective 2
- Queensland research on opportunities for the intensification of summer cropping have confirmed that relay cropping a legume crop into a standing maize crop with high levels of stored moisture during grain filling can double land productivity and farmers profits in a second year of on—station experiments.
- So far APSIM has been used to simulate on-farm and on-station experimental results from all 5 SIMLESA countries and from 6 of the 11 agro-ecologies.
- Participatory modeling and initial farmer engagement in Ethiopia’s Central Rift Valley region helped frame research questions for Solomon Hassen’s research project.

SIMLESA Objective 5
- Daniel Rodriguez was appointed Course Advisor for the ADS Scholarships 2014. A number of SIMLESA country students applied and at this moment are going through their interviews in Nairobi.
- Daniel Rodriguez continued the supervision and co-supervision of Nascimento Nathumbo, Abeya Tefera, Solomon Jemal and Yohannis Mulu.
Achievements against Activities, Outputs and Milestones

Objective 1: Socio economics, Markets and Value chains (research papers in progress)

Phase I Activity 1.2.4 Participatory diagnosis of rainfed maize and maize-legume systems options in Queensland, Australia

From March to July 2014 a survey and workshop were conducted to re-evaluate and identify new opportunities for summer cropping intensification. These activities were designed to answer 3 questions for the major cereal crops in the region, i.e. wheat, sorghum and maize.

• What are the gaps in information on cereal agronomy in the northern region?
• What are the priorities for agronomic experimentation?
• What information will be most useful to farmers?

Survey

The survey remains open and we aim to get responses from at least 50 people. Initial results are shown below.
Where are the growers surveyed farms?
What are other factors to consider when growing sorghum?

- Rotation (6)
- New variety trials and nutrient trials (2)
- Drought tolerance
- Dry down, desiccation, grazing/hay value
- Establishment

Price

What are other factors to consider when growing maize?

- Markets (2)
- Soil benefits
- Earlier sowing window
- Residual moisture for double cropping
- Price
What other macro and micro nutrients are important?
- Soil health (2)
- Amelioration of sodic soils
- Mn, B, Si, Mo
- Deep P and K applications
- Response to liquid injected starters

What information on crop management practices is needed?
- Variety performance under contrasting environments (drought tolerance)
- Short cycle varieties, early planting of sorghum and cold tolerance
- High protein varieties
- Standability in sorghum
- Legume rotations, green manure crops
- NVT for maize and sorghum
- How to grow high yielding irrigated sorghum and maize
- Systems to maximise planting seed bed moisture and extend planting window

In addition to high yield, what characteristics are most important in selecting a new sorghum / maize?
- Standability (9)
- Grain size (4)
- Drought tolerance (4)
- Midge tolerance (2)
- Yield potential and stability (2)
- Cold tolerant (2)
- Low tillering
- Heat stress (2)
- Evenness of maturity
- Short season maize
- Low stay green
- Good dry down for harvesting

What information could help you increase yields and profits?
- Optimum N management (3)
• Optimum plant densities (2)
• Local variety trials
• More predictable prices
• Better soil tests
• Optimum planting date
• Precision agriculture (zoning)
• Access to APSIM results (private consultant)
• Information on market requirements
• NVT type of information for sorghum and maize and field days

What information could help you manage better climate risks?
• Accurate seasonal climate forecasts (7)
• Accurate weather forecasts
• More independent testing of varieties
• Heat tolerance at flowering
• Keep breeding new varieties
• Knowing better plant water available capacity (management zones)
**Workshop priorities summary**

A series of crop summaries were developed based on the survey responses along with feedback from a panel discussion at the cereals workshop.

<table>
<thead>
<tr>
<th>Risk management</th>
<th>Wheat</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nitrogen management with uncertain rainfall: Needs to be informed by farmers’ risk attitudes in addition to price ratios</td>
<td></td>
</tr>
<tr>
<td>Decisions need to be supported by simple rules of thumb based on initial soil water - the accuracy of seasonal climate forecasts is unlikely to improve</td>
<td></td>
</tr>
<tr>
<td>There is room to improve the use of existing forecasts with the addition of site specific information</td>
<td></td>
</tr>
<tr>
<td>More site specific solutions based on spatial variability in soil fertility</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>GxExM</th>
<th>Wheat</th>
</tr>
</thead>
<tbody>
<tr>
<td>NVT: easier accessibility to the information, better packaging and delivery</td>
<td></td>
</tr>
<tr>
<td>Varieties: not enough information for farmers to select and optimise management of different varieties</td>
<td></td>
</tr>
<tr>
<td>Seed systems: lack of varieties with early breaks and for those making late decisions</td>
<td></td>
</tr>
<tr>
<td>Worrying decline trend in wheat yield increases (particularly when compared to maize).</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>R&amp;D investment</th>
<th>Wheat</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lack of “blue sky” investment</td>
<td></td>
</tr>
<tr>
<td>More innovative ways to increase crop water and nutrients use efficiencies – rather than resource capture</td>
<td></td>
</tr>
<tr>
<td>Frost tolerance and avoidance of high temperature stress in spring</td>
<td></td>
</tr>
<tr>
<td>Precision agriculture</td>
<td></td>
</tr>
<tr>
<td>Risk management</td>
<td></td>
</tr>
<tr>
<td>Varieties x management to maximise growth during stem elongation and trade offs with risk</td>
<td></td>
</tr>
<tr>
<td>Model based predictions aware of soil type differences within fields</td>
<td></td>
</tr>
<tr>
<td>Maize</td>
<td></td>
</tr>
<tr>
<td>---------------------------</td>
<td></td>
</tr>
<tr>
<td><strong>GxExM</strong></td>
<td></td>
</tr>
<tr>
<td>Planting times x maturity x densities</td>
<td></td>
</tr>
<tr>
<td>Prolificity x density</td>
<td></td>
</tr>
<tr>
<td>Wide rows x prolificity in poor environments</td>
<td></td>
</tr>
<tr>
<td>Nitrogen management and NUE</td>
<td></td>
</tr>
<tr>
<td><strong>Physiology</strong></td>
<td></td>
</tr>
<tr>
<td>Drought tolerance i.e. water extraction patterns, ASI, heat tolerance, leaf rolling, yield stability and responses to density</td>
<td></td>
</tr>
<tr>
<td><strong>Environmental characterisations</strong></td>
<td></td>
</tr>
<tr>
<td>Site selection for targeted environments (stress types).</td>
<td></td>
</tr>
<tr>
<td><strong>Maize vs Sorghum</strong></td>
<td></td>
</tr>
<tr>
<td>Either increase productivity or reduce production costs to be an option to sorghum (reduce cost by $50/ha of feed maize</td>
<td></td>
</tr>
<tr>
<td>Sorghum</td>
<td></td>
</tr>
<tr>
<td>--------------------------</td>
<td></td>
</tr>
<tr>
<td><strong>Priorities identified by farmers</strong></td>
<td></td>
</tr>
<tr>
<td>Timing of N application</td>
<td></td>
</tr>
<tr>
<td>Field specific agronomy (soil type / field history aware)</td>
<td></td>
</tr>
<tr>
<td>Risk management</td>
<td></td>
</tr>
<tr>
<td>The future of cropping without Round-Up</td>
<td></td>
</tr>
<tr>
<td>Stagnated yield increases: management or breeding?</td>
<td></td>
</tr>
<tr>
<td>Better information on hybrids</td>
<td></td>
</tr>
<tr>
<td>Farm level environmental characterisations</td>
<td></td>
</tr>
<tr>
<td><strong>Priorities identified by agros</strong></td>
<td></td>
</tr>
<tr>
<td>Planting rates and times</td>
<td></td>
</tr>
<tr>
<td>Optimum N management</td>
<td></td>
</tr>
<tr>
<td>Yield stability and standability</td>
<td></td>
</tr>
<tr>
<td>Seed supply (Concept II treated seed)</td>
<td></td>
</tr>
<tr>
<td>Broad adaptation of hybrids means that best practice agronomy might not differ much between hybrids. Extreme types are not popular</td>
<td></td>
</tr>
<tr>
<td><strong>Priorities identified by researchers</strong></td>
<td></td>
</tr>
<tr>
<td>Site-specific management and precision agriculture</td>
<td></td>
</tr>
<tr>
<td>Late application of nitrogen contingent to seasonal conditions</td>
<td></td>
</tr>
<tr>
<td>GxM targets for specific environments e.g. tillering x population combinations targeted for contrasting environments</td>
<td></td>
</tr>
</tbody>
</table>
Identification of household characteristics that affect the technical efficiency of maize production for smallholder farms (Tanzanian example)

(at the moment a journal paper across all SIMLESA countries is being prepared for submission)

Brendan Power and Daniel Rodriguez

The importance of maize production to the food security of Africans cannot be overstated. It is the most widely grown and consumed cereal crop in Sub Saharan Africa and hence key to achieve food security among up to 80% of the population. In this study we used stochastic frontier analysis to identify the bio-physical and socio-economic characteristics that contribute positively to high technical efficiencies (relative to their peers) for total household maize production.

Households were selected for the survey via a multi-stage sampling regime, which ensured adequate coverage of maize production areas in Tanzania. This resulted in approximately 700 households from three different regions and two agro-ecological zones (see Table 1). A small number of households were removed due to either recorded maize yields greater than 10 t/ha, or households with recorded maize production and no associated labour use. Data collected included details about socio-economic characteristic, and field and farm management (Rodriguez et al., this report).

Table 1: Number of households surveyed from each region and agro-ecological zone

<table>
<thead>
<tr>
<th>Zone</th>
<th>Region</th>
<th>Households</th>
</tr>
</thead>
<tbody>
<tr>
<td>East</td>
<td>Morogoro</td>
<td>350</td>
</tr>
<tr>
<td>North</td>
<td>Arusha</td>
<td>179</td>
</tr>
<tr>
<td></td>
<td>Manyara</td>
<td>168</td>
</tr>
</tbody>
</table>

A Stochastic frontier analysis was first independently proposed by Aigner et al. (1977) and Meeusen and Van den Broeck (1977), and further extended to quantify the effects of environmental variables on the economic efficiency of the farm (Battese and Coelli, 1995). The technique involves parametrically estimating a stochastic production frontier of the form:

\[ \ln q_i = x_i' \beta + v_i - u_i \]  

(1)

Where: \( q_i \) is the output of the \( i \)th farm i.e. maize production in this study; \( x_i \) is a vector of inputs for maize production for the \( i \)th household, \( \beta \) is a vector of estimated parameters, \( v_i \) is symmetric random noise which is independently and identically distributed \( N(0, \sigma^2) \) and is assumed to be independent of \( u_i \), the technical inefficiency. This is modelled by:

\[ u_i = z_i' \delta + W_i \]  

(2)

Where: \( z_i \) is a vector of household specific explanatory variables, \( \delta \) is a vector of unknown parameters that are estimated simultaneously with the \( \beta \) parameters from the stochastic production frontier (Eq. 1), and \( W \) is a random variable from the truncated normal distribution. The model is estimated using the method of maximum likelihood using the R implementation of the computer program Frontier Version 4.1 (Coelli, 1996; Coelli and Henningsen 2012).

The cross sectional household survey data was used to estimate the parameters of Eq. 1 and 2, for each of the Tanzanian agro-ecological zones (i.e. East and North). This assumes each zone is a homogenous production environment. Variables listed in Table 2 were used to estimate the stochastic production function (Eq. 1) in different combinations to determine those that were significant. These explanatory variables were
mean-corrected (i.e. means was subtracted from each value) which ensures each variable has a mean zero and it’s first order parameter estimates are output elasticities (Villano and Fleming, 2006). A translog functional form was assumed. This includes second order and interaction terms, and is a more general form of the Cobb-Douglas production function. The nested technically inefficiency model (Eq. 2) was determined by evaluating the different combinations of approximately 30 variables (not shown) that describe the different cultural, bio-physical and socio-economic characteristic of the households.

**Table 2:** Variables evaluated in stochastic production function of maize production at the farm level.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Parameter</th>
<th>Estimate</th>
<th>Std. Error</th>
<th>p.value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Area planted (ha)</td>
<td>β0</td>
<td>0.72</td>
<td>0.08</td>
<td>0.00</td>
</tr>
<tr>
<td>Applied herbicide (L)</td>
<td>β1</td>
<td>1.45</td>
<td>0.18</td>
<td>0.00</td>
</tr>
<tr>
<td>Applied fertiliser ($)</td>
<td>β2</td>
<td>0.22</td>
<td>0.07</td>
<td>0.00</td>
</tr>
<tr>
<td>Ox plough days</td>
<td>β3</td>
<td>-0.86</td>
<td>0.25</td>
<td>0.00</td>
</tr>
<tr>
<td>Labour (hrs)</td>
<td>β4</td>
<td>0.31</td>
<td>0.16</td>
<td>0.05</td>
</tr>
<tr>
<td>(Area planted)(Labour)</td>
<td>β5</td>
<td>-0.23</td>
<td>0.13</td>
<td>0.09</td>
</tr>
<tr>
<td>Education</td>
<td>δ0</td>
<td>-0.15</td>
<td>0.08</td>
<td>0.08</td>
</tr>
<tr>
<td>Institutions</td>
<td>δ1</td>
<td>-1.36</td>
<td>0.79</td>
<td>0.09</td>
</tr>
<tr>
<td>Training</td>
<td>δ2</td>
<td>-0.34</td>
<td>0.19</td>
<td>0.07</td>
</tr>
</tbody>
</table>

The maximum likelihood parameter estimates for the final stochastic frontier model (Eq. 1) and the nested inefficiency effects model (Eq. 2) for East and North Tanzania are listed in Tables 3 and 4, respectively. In Eastern Tanzania the level of education of the household head, the number of institutions the household head was a member, and the number of training activities undertaken, all contributed significantly to reducing technical inefficiency for the household maize production. In Northern Tanzania the household characteristics that significantly reduced the technical inefficiency were: the level of education of the household head, whether the household head’s main occupation is a farmer, whether harvested maize was stored securely from pests; and the number of cattle that belong to the household. An increase in inefficiency of maize production occurs if the household head is single (irrespective of gender).

**Table 3:** Maximum likelihood estimates for stochastic frontier production and inefficiency effects model for the Eastern agro-ecological zone of Tanzania.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Parameter</th>
<th>Estimate</th>
<th>Std. Error</th>
<th>p.value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>β0</td>
<td>0.72</td>
<td>0.08</td>
<td>0.00</td>
</tr>
<tr>
<td>Area planted</td>
<td>β1</td>
<td>1.45</td>
<td>0.18</td>
<td>0.00</td>
</tr>
<tr>
<td>Labour</td>
<td>β2</td>
<td>0.22</td>
<td>0.07</td>
<td>0.00</td>
</tr>
<tr>
<td>(Area planted)^2</td>
<td>β3</td>
<td>-0.86</td>
<td>0.25</td>
<td>0.00</td>
</tr>
<tr>
<td>(Area planted)(Labour)^2</td>
<td>β4</td>
<td>0.31</td>
<td>0.16</td>
<td>0.05</td>
</tr>
<tr>
<td>(Labour)^2</td>
<td>β5</td>
<td>-0.23</td>
<td>0.13</td>
<td>0.09</td>
</tr>
<tr>
<td>Education</td>
<td>δ0</td>
<td>-0.15</td>
<td>0.08</td>
<td>0.08</td>
</tr>
<tr>
<td>Institutions</td>
<td>δ1</td>
<td>-1.36</td>
<td>0.79</td>
<td>0.09</td>
</tr>
<tr>
<td>Training</td>
<td>δ2</td>
<td>-0.34</td>
<td>0.19</td>
<td>0.07</td>
</tr>
</tbody>
</table>
Table 4: Maximum likelihood estimates for stochastic frontier production and inefficiency effects model for the Northern agro-ecological zone of Tanzania.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Parameter</th>
<th>Estimate</th>
<th>Std. Error</th>
<th>p.value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>β₀</td>
<td>1.25</td>
<td>0.07</td>
<td>0.00</td>
</tr>
<tr>
<td>Area planted</td>
<td>β₁</td>
<td>1.36</td>
<td>0.20</td>
<td>0.00</td>
</tr>
<tr>
<td>Labour</td>
<td>β₂</td>
<td>0.47</td>
<td>0.07</td>
<td>0.00</td>
</tr>
<tr>
<td>(Area planted)^2</td>
<td>β₃</td>
<td>-0.52</td>
<td>0.60</td>
<td>0.39</td>
</tr>
<tr>
<td>(Area planted)(Labour)</td>
<td>β₄</td>
<td>0.25</td>
<td>0.24</td>
<td>0.29</td>
</tr>
<tr>
<td>(Labour)^2</td>
<td>β₅</td>
<td>-0.07</td>
<td>0.18</td>
<td>0.67</td>
</tr>
<tr>
<td>Education</td>
<td>δ₁</td>
<td>-0.61</td>
<td>0.21</td>
<td>0.00</td>
</tr>
<tr>
<td>Farmer</td>
<td>δ₂</td>
<td>-4.80</td>
<td>2.16</td>
<td>0.03</td>
</tr>
<tr>
<td>Grain store</td>
<td>δ₃</td>
<td>-1.81</td>
<td>0.86</td>
<td>0.03</td>
</tr>
<tr>
<td>Single</td>
<td>δ₄</td>
<td>2.36</td>
<td>0.82</td>
<td>0.00</td>
</tr>
<tr>
<td>Cattle</td>
<td>δ₅</td>
<td>-0.47</td>
<td>0.06</td>
<td>0.00</td>
</tr>
</tbody>
</table>

Results demonstrate that stochastic frontier analysis is a useful technique in identifying household characteristics that explain why some farmers are more efficient than others. Similar analyses are currently being conducted for Ethiopia, Kenya, Malawi, and Mozambique.

The authors wish to thank the ACIAR funded (http://aciar.gov.au/simlesa) SIMLESA program (http://simlesa.cimmyt.org).

References


Objective 2: To test and develop productive, resilient and sustainable smallholder maize-legume cropping systems and innovation systems for local scaling out

Activity 2.4.6: Eco-physiological analysis of intercropped maize-legume production systems
Opportunistic maize-legume relay cropping systems in north-eastern Australia


aQueensland Alliance for Agriculture and Food Innovation (QAAFI), The University of Queensland PO Box 102 Toowoomba Qld 4350 Australia

*j.eyre@uq.edu.au

8.1 Introduction

In Queensland, Australia rainfall is mostly summer dominant (Sadras and Rodriguez 2007) and highly variable (Potgieter et al. 2007), driving the high variability in grain yields (Doherty et al. 2010). Furthermore, climate change predictions indicate that annual rainfall will decline over the next 20 to 40 years in this region. This climate variability has driven the development of agronomic systems, such as skip row planting that manage crop exploration of stored soil moisture, i.e. crop water supply and more consistently decrease the frequency of low and negative financial returns in seasons with below average in-crop rainfall. These systems are widely utilised and provide the grains industry with excellent tools to manage climate risk, but in doing so limit maximum potential yield and decrease water use efficiency, increase erosion and some weeds proliferate in high rainfall seasons.

Minimising pre-anthesis crop canopy with a view to reducing evapotranspiration and then intensifying production in-crop following rainfall could both minimise climate risk and maximise capture and utilisation of rainfall thereby increasing productivity and profitability in this region. Initial plant available water and seasonal climate forecasts (e.g. southern oscillation index; SOI) have a strong correlation with summer crop yield potential thereby guiding the level of crop intensification at sowing (Carberry et al. 2000). Nitrogen applied to the crop between floral initiation and anthesis can effectively increase yield potential (Binder et al. 2000), but both of these intensification technologies are restricted to a finite period at sowing and during the early vegetative crop growth phase. During the highest rainfall seasons some farmers grow a winter crop following the harvest of the summer crop. This opportunistic sequential summer-winter cropping systems in typically referred to as “double cropping”. The summer crop grows during a time of the year with ample availability of resources (i.e. solar radiation, temperature and rainfall), while the second crop is grown later when radiation and rainfall are declining. Additional constraints to double cropping in high rainfall seasons potentially arise due to the need to delay summer crop harvest until grain and/or the topsoil is sufficiently dry and a rainfall event plus a suitable planting date may be required to sow a double crop. More technologies are needed to exploit additional rainfall throughout the crop lifecycle, especially from anthesis to physiological maturity.

Controlled traffic farming and precision agriculture are facilitating the implementation of novel mechanised intercropping systems with increases in resource capture and use efficiency driving productivity gains in North and South America and Asia. Intercropping is sowing two or more crops in the same area and space simultaneously while relay cropping is sowing second or more crops into an established crop. However, interspecific competition and practical crop management practices can limit the value of multi-crop arrangements. Initial research indicated that yield of maize and mungbean decreased by 30-45% and 55 to 60%, respectively, when grown in a 2 by 2 row replacement intercropping system compared to monoculture. Better matching the phenology of multiple-crops and optimising population densities and spatial and temporal arrangement could potentially reduce competition and increase land use efficiency compared to current practices..

Relay cropping has the potential to minimise and potentially eliminate inter-specific competition thereby maintaining yields similar to those obtained in monoculture systems by temporally offsetting critical growth and development periods for each component crop. Relay cropping systems can maintain an actively growing ground cover for a longer duration than monoculture or simultaneously planted intercrops thereby increasing resource capture and utilisation. In addition, relay crops can facilitate crop production in a more opportune manner than double cropping. This is
especially important where the cropping windows are shortened by water availability, temperature and/or solar radiation.

Relay cropping into maize may be an especially advantageous system because the physiologically mature plants can remain in the field for months because postharvest grain drying is not common in Australian due to budgetary and quality issues. From the late grain filling stage, the maize plant has rapidly diminishing use of soil water and nutrients and solar radiation interception by the senescing canopy. These underutilised resources could be captured by a relay crop and the senescent maize canopy may provide protection the relay crop from frost, insect damage and wind damage. A relay crop could also provide weed control, which is particularly problematic with late summer sowings in Australia during the dry down period and protection against soil erosion.

Here we hypothesise that dry land cropping systems can be intensified by (i) relay cropping a second species in response to favourable in-crop conditions (i.e. higher than average expected rainfall), and that production increases will be due to (ii) increased resource capture, and/or (iii) increased recourse use efficiency; that (iv) delaying the sowing of the relay crop will sequentially reduce inter-specific competition, and that (v) this will increase land use efficiency compared to current option of double cropping (which is constrained by high probability of delayed or missed planting opportunities).

8.2 Materials and methods

Site and management

Experiments were conducted at the Gatton Research Station Queensland, Australia (27.55°S, 152.33°E). The soil is an alluvial, weakly cracking vertisol (USDA taxonomy: Typic Chromustert) with a friable sandy clay loam D horizon from 0.8 to 1.8 m deep (Powell 1982). All experiments were initiated following at least 12 months bare fallow and with a full soil water profile as determined by gravimetric measurements to 1.8 m deep and know characterisation of the drained upper limit (www.apsim.info/Products/APSoyl.aspx ). Maize was sown into a fine tilth at 2-4 times the required population during the typical planting windows for this locality (spring [early September to mid October] or summer [late December to early February]) and then thinned to the target population at the 3-leaf stage. An overhead irrigation of 25 mm was applied to all plots on the day of sowing to assist establishment and incorporate pre-emergent residual herbicide (3.4 l/ha Stomp® 440, Crop Care Australasia, Australia; a.i. 440 g/l pendimethalin) thereafter half of the plots were supplement irrigated to achieve a water unlimited environment the remaining plots were rain fed. Irrigation for water unlimited plots was scheduled when crop leaves appeared water stressed by mid morning (c.a. 10:00 h) or when the Agricultural Production Systems Simulator (APSIM; Keating et al. 2003) simulated an imminent water deficit. Ammonium sulphate (1/3 of total applied N) and urea (2/3 of total applied N) were incorporated into the soil pre-sowing at rates to target non-nutrient limiting conditions based on soil tests and an expected maize grain yield of 10 t/ha. Foliar sprays of zinc and boron chelates were applied to maize at the 4-6-leaf stage as per local recommendations. Weeds were controlled before they reached c.a. 15 cm tall with cultivation and spot glyphosate spraying. Vertebrate pests were managed by fencing and netting plants in the yield quadrant at susceptible periods following anthesis. Heliothis, mites and pod borers were managed with an integrated pest management program (IPM) that included releases of predatory insects and prophylactic applications of IPM compatible chemical pesticides (a.i. chlorantraniliprole). Mungbean were sprayed prophylactically for powdery mildew with fungicides (a.i. tebuconazole) from the first flowering stage. No other pests or diseases were observed at potentially damaging levels during the trials. Local meteorological records were obtained from a weather station installed adjacent to the site or The Bureau of Meteorology (http://www.bom.gov.au; station i.d: 040082, 27.54 °S, 152.34 °E).

8.2.1 Treatments

Crops were sown into a cultivated seedbed in two growing spring-summer seasons from the 14th October 2011 to 7th March 2012 (season 1) and from 9th September 2012 to 18th February 2013 (season 2).

Maize cv. 34N43 was sown in solid rows with an inter-row spacing of 1.0 m in a north-south direction. Inoculated (Nodulaid™ Group I; Becker Underwood) mungbean cv. Crystal was sown at 40 plants/m² in a single row in the middle
row of the inter-row space of the standing maize crop (i.e. relay cropped) and bare fallow (i.e. sole cropped) at nine leaf (V9), mid grain fill (R3.5) and physiological maturity (Black layer; R6) maize phenological stages. Monoculture/sole crop comparators were also sown simultaneously into a fallow to the north of the relay crop plots and a double crop option was sown after maize harvest (kernel moisture content was 14-16% approximately 30 after physiological maturity) into the maize stubble and the fallow.

8.2.2 Growth, development and yield measurements

Plant counts were conducted after germination, thinning and at harvest. Maize and mungbean heights, green leaf number, total leaf number, growth stage were measured fortnightly on 10 consecutive plants. Growth stage was measured daily during the anthesis to silking period. “The dates of anthesis (extension of anthers on more than 50% of the tassel or panicle) were determined by regular inspection and scoring 5 adjacent plants per sub-plot. During grain-filling, 3 ears of maize or 4 panicles of sorghum and millet were removed at 3-4-day intervals from plants that were tagged on the same anthesis date in each sub-plot; 20 grains were removed progressively along the ears or panicles from each sample to score the development of black-layer taken as the presence of black-layer on 90% of grains. Above ground biomass was harvested from a 2 m² quadrant at late vegetative, early grain fill, and physiological maturity for maize and 1st flower, maize R6 and maize harvest for mungbean. All plants from the biomass cut were dissected into stem, leaf, and inflorescence and the green leaf area was quantified. Each component and the remaining biomass cut were dried at 80°C until constant weight. All cobs/pods were harvested from an 8 m² quadrant to determine final grain yield.

8.2.3 Experimental Design

Treatments were blocked in split-plot design with irrigation as a main factor plot and mungbean sowing time relative to maize growth stage as sub-plots. Sowing time treatments were maize growth stages of vegetative nine-leaf (V9), mid grain fill (R3.5), physiological maturity (R6) and double cropping (DC) following maize harvest (14-16% kernel moisture). Monoculture sole mungbean was simultaneously sown at each relay-cropping period on plots at the northern edge of the relay crop experiment. Monoculture mungbean treatments were planted in a separate trial site to generate an environment more representative of monoculture field crops than within the potential protection by bordering maize plots similar to strip cropping which would be common in a completely randomised trial. Each plot was 15 m long and 6 m wide (i.e. 6 rows x 1 m/row) with at least 4 m of relevant species bordering the experiment site. All biomass and yield harvests were protected by a 1 m boarder. Frequent and higher than median in-crop rainfall occurred in each season and as a result there was no statistical difference between irrigated and rain fed treatments. Therefore, the irrigation term was dropped and the experiments were analysed as species (maize or mungbean) by sowing time (V9, R3.5, R6 or DC) for each experiment by ANOVA (Genstat). Yield, biomass and population were log₁₀ transformed for to normalise distribution before analysis. Statistically significant means were separated by least significant difference (LSD) and back transformed means are presented where appropriate. Arithmetic means and confidence intervals were calculated for comparisons of treatments between experiments.

8.3 Results and Discussion

The grain yield, above ground biomass and HI of sole and relay cropped maize were unaffected by supplemental irrigation (data not shown) and relay cropping with mungbean at any evaluated phenological stage (V9, R3.5 and R6; Table 1). Irrigation had small and inconsistent yet significant affects ($P \leq 0.05$) on relay cropped mungbean, but relay mungbean sowing time relative to maize phenology explained greater than 90% of the plot-to-plot variability (ANOVA sum of squares) and had the greatest and a consistent influence on grain yield, above ground biomass and harvest index (Fig 1). In-crop rainfall was above average, frequently occurred during critical yield determining stages and no evidence of water stress was observed through the experimental period. Therefore, the mungbean component, and its sowing time in particular, had the greatest influence on overall relay cropping system productivity as indicated by the LER and only the main effects of sowing time and species are shown in table (Table 1). The yield of relay cropped mungbean relative to simultaneously sown monoculture mungbean increased at planting times closest to maize physiological maturity. The LER was developed for simultaneous intercropping and is independent for cropping
duration and as such careful interpretation is required when evaluating cropping system intensification. This is especially important where alternative systems such as longer duration monoculture crops and optimised sequential winter-summer double cropping options exist. The LER also increased for double cropping treatments because the double crop mungbean yield was similar or greater than monoculture mungbean sown simultaneously. However, actual double crop mungbean yields following both maize and fallow rotations declined because they were sown outside of the optimal sowing window and were subject to sub-optimal temperatures.

Gross margins of maize-mungbean relay crops sown at maize physiological maturity was 1.5 fold higher than sole maize and 3.0 fold greater than the highest grossing sole mungbean crop. Variable costs for the maize relay cropping system were higher than sole maize because of the additional costs of a pre-emergent residual herbicide (a.i. pendimethalin) that is compatible with both relay component crops (Table 2). Supplementary irrigation was used as a research tool to simulate planting opportunities and high rainfall not an irrigation crop. Therefore, the costs of irrigation were not included in the gross margin. All other production costs were identical for the relay crops and each individual component crop cultivated in a traditional sole system. It was assumed that grain quality and therefore cropping system did not influence returns per unit grain.

### 8.4 Conclusion

Relay cropping mungbean into senescing maize can increase productivity and profitability of grain growers in Queensland, Australia. Relay crops extend the period for in-crop intensification and potentially reduce climate risk because the intensification decision can be made after rainfall. Further research is required to understand the microclimate within the senescing maize canopy and the physiological bases for the relay crop evapotranspiration. Then the spatial distribution and frequency of opportunities and yield potential for relay cropping mungbean into standing maize should be tested against other intensification options via cropping system simulation.

### 8.5 References


Table 1. The effect of mungbean sowing time on the yield, above ground biomass, harvest index (HI) and land equivalence ratio (LER) of sole and relay cropped maize-mungbean cropping systems at Gatton, Queensland.

Means with the same letter are not significantly different at the $P = 0.05$ level.

<table>
<thead>
<tr>
<th>Cropping system</th>
<th>Mungbean sow date</th>
<th>Yield t/ha (log$_{10}+1$) maize†</th>
<th>Biomass t/ha (log$_{10}+1$) maize</th>
<th>HI maize</th>
<th>HI mung</th>
<th>LER (95% CI) ‡ (yield)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(maize growth stage)†</td>
<td>maung†</td>
<td>maung</td>
<td>maung</td>
<td>maung</td>
<td></td>
</tr>
<tr>
<td>Sole mungbean</td>
<td>Nov 22 (V9)</td>
<td>-</td>
<td>0.73$^b$</td>
<td>0.03(0.013)$^e$</td>
<td>16.89(1.253)$^a$</td>
<td>0.47(0.168)$^d$</td>
</tr>
<tr>
<td>Sole mungbean</td>
<td>Jan 19 (R3.5)</td>
<td>-</td>
<td>0.89$^b$</td>
<td>1.17(0.336)$^c$</td>
<td>17.06(1.257)$^a$</td>
<td>2.71(0.569)$^c$</td>
</tr>
<tr>
<td>Sole mungbean</td>
<td>Feb 10 (R6)</td>
<td>-</td>
<td>1.64$^a$</td>
<td>1.58(0.412)$^b$</td>
<td>3.87(0.688)$^c$</td>
<td>-§</td>
</tr>
<tr>
<td>LSD</td>
<td></td>
<td>- 0.30</td>
<td></td>
<td></td>
<td>0.49</td>
<td>-</td>
</tr>
<tr>
<td>Mid-vegetative relay</td>
<td>Nov 22 (V9)</td>
<td>9.44(1.019)$^a$</td>
<td>0.03(0.013)$^e$</td>
<td>16.89(1.253)$^a$</td>
<td>0.47(0.168)$^d$</td>
<td>0.49$^a$</td>
</tr>
<tr>
<td>Mid-grain fill relay</td>
<td>Jan 19 (R3.5)</td>
<td>8.40(1.024)$^a$</td>
<td>1.17(0.336)$^c$</td>
<td>17.06(1.257)$^a$</td>
<td>2.71(0.569)$^c$</td>
<td>0.49$^a$</td>
</tr>
<tr>
<td>Mature relay§</td>
<td>Feb 10 (R6)</td>
<td>1.58(0.412)$^b$</td>
<td>3.87(0.688)$^c$</td>
<td>-§</td>
<td>0.37$^d$</td>
<td>1.97 (1.84, 2.09) §</td>
</tr>
<tr>
<td>Double cropped§</td>
<td>Mar 7 (Postharvest)</td>
<td>8.23(1.016)§</td>
<td>0.27(0.105)$^d$</td>
<td>16.71(1.248)§</td>
<td>2.74(0.573)$^c$</td>
<td>0.49$^a$</td>
</tr>
<tr>
<td>LSD</td>
<td>(0.028)</td>
<td>(0.046)</td>
<td></td>
<td></td>
<td></td>
<td>0.07</td>
</tr>
</tbody>
</table>
Table 1. Continued.

<table>
<thead>
<tr>
<th>Cropping system</th>
<th>Mungbean sow date</th>
<th>Yield t/ha (log_{10}+1)</th>
<th>Biomass t/ha (log_{10}+1)</th>
<th>HI</th>
<th>LER (95% CI)‡</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>maize†</td>
<td>mung†</td>
<td>maize</td>
<td>mung</td>
</tr>
<tr>
<td>(maize growth stage)#</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Exp. 3. Conventional sole mungbean crops 2012-2013. n = 8.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sole mungbean</td>
<td>Dec 18 (R3.5)</td>
<td>-</td>
<td>1.57a</td>
<td>-</td>
<td>8.13b</td>
</tr>
<tr>
<td>Sole mungbean</td>
<td>Jan 15 (R6)</td>
<td>-</td>
<td>1.82a</td>
<td>-</td>
<td>8.65a</td>
</tr>
<tr>
<td>Sole mungbean</td>
<td>Feb 18 (Postharvest)</td>
<td>-</td>
<td>1.00b</td>
<td>-</td>
<td>4.71c</td>
</tr>
<tr>
<td>LSD</td>
<td></td>
<td>-</td>
<td>0.28</td>
<td>-</td>
<td>0.31</td>
</tr>
<tr>
<td>Mid-grain fill relay</td>
<td>Nov 22 (R3.5)</td>
<td>9.63(0.975)a</td>
<td>0.75(0.223)</td>
<td>19.32(1.263)a</td>
<td>4.8(0.580)c</td>
</tr>
<tr>
<td>Mature relay§</td>
<td>Jan 19 (R6)</td>
<td>9.29(0.962)a</td>
<td>1.91(0.432)</td>
<td>17.83(1.226)b</td>
<td>10.02(0.955)c</td>
</tr>
<tr>
<td>Double cropped§</td>
<td>Feb 18 (Postharvest)</td>
<td>9.75(0.980)a</td>
<td>1.69(0.400)</td>
<td>19.2(1.260)a</td>
<td>7.4(0.806)d</td>
</tr>
<tr>
<td>LSD</td>
<td></td>
<td></td>
<td>(0.024)</td>
<td>(0.029)</td>
<td>0.02</td>
</tr>
</tbody>
</table>

#Maize was sown 14th Oct 2011 or 13th Sep 2012 and then harvested on 3rd Mar 2012 and 18th Feb 2013, respectively at c.a. 14% grain moisture content. Maize growth stages are defined at http://maizedoctor.cimmyt.org/en/getting-started/9?task=view
†Maize and mungbean yields were normalised to 14% and 12% moisture content, respectively.
‡Arithmetic means and propagation of variance for yields were derived from each experiment to calculate the LER and its confidence interval.
§Both maize and mungbean were sown in every intensification plot (Exp. 2 & 4), but maize was not harvested from all plots to minimise plot traffic. Therefore, sole cropped maize and maize relay cropped at physiological maturity (R6) were assumed to be the same as double cropped maize yields.
Table 2. The effect of mungbean sowing time on the yield, relative yield and land equivalence ratio (LER) of sole and relay cropped maize-mungbean cropping systems at Gatton, Queensland. Means with the same letter are not significantly different at the $P = 0.05$ level. $n = 6$.

<table>
<thead>
<tr>
<th>Cropping system</th>
<th>Gross margin $$/ha</th>
<th>Maize†</th>
<th>Mungbean†</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Conventional sole mungbean crops</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sole mungbean sown Nov 22 (V9)</td>
<td>-</td>
<td>170.6b</td>
<td>170.6</td>
<td></td>
</tr>
<tr>
<td>Sole mungbean Jan 19 (R3.5)</td>
<td>-</td>
<td>295.3b</td>
<td>295.3</td>
<td></td>
</tr>
<tr>
<td>Sole mungbean Feb 10 (R6)</td>
<td>-</td>
<td>901.2a</td>
<td>901.2</td>
<td></td>
</tr>
<tr>
<td><strong>Maize-mungbean relay crops</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mungbean sown into maize Nov 22 (V9)</td>
<td>1808a</td>
<td>-399e</td>
<td>1409</td>
<td></td>
</tr>
<tr>
<td>Mungbean sown into maize Jan 19 (R3.5)</td>
<td>1840a</td>
<td>579c</td>
<td>2419</td>
<td></td>
</tr>
<tr>
<td>Mungbean sown into maize Feb 10 (R6)</td>
<td>N/Ae</td>
<td>858b</td>
<td>2666</td>
<td></td>
</tr>
<tr>
<td>Mungbean sown after maize harvest Mar 7 (DC)</td>
<td>1808a</td>
<td>-119d</td>
<td>1689</td>
<td></td>
</tr>
<tr>
<td><strong>LSD</strong></td>
<td>-</td>
<td>242.7</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

§Sole cropped maize and maize relay cropped at physiological maturity (R6) were assumed to be the same as double cropped maize yields.

**Activity 2.4.7: Best management practices for maize-legume systems identified**

To effectively analyze best management practices for maize and legume systems to deliver short and long term benefits on crop production, soil health and risk reduction a combination of field experimentation and model applications is envisaged. In 2012/13 a number of model calibrations and performance evaluations have been undertaken using SIMLESA’s field trial results.

**Evaluation of APSIM to simulate crop responses in conservation agriculture systems: Calibrations for maize-bean intercropping**

Maize-legume intercropping is a major thrust of SIMLESA’s intensification strategy to enhance resource use efficiency. To initially simulate observed on-farm results at Kakamega, rooting depth of the bean crop had to be constrained to very shallow depths (eg. 0-30cm) in APSIM, else it out-competed the maize crop when sown on the same date (Fig 1, LHS).

Key default input coefficients for the bean module were identified as the stem weight to height relationship (5 g at 1m height) and the initial leaf area at emergence (400mm²). Sensitivity analysis varied these inputs for maize-bean intercrops at Kakamega, Kenya and found that the combination of 20g and 50mm² was needed in order for the bean crop not to dominate maize growth (see Fig 1, RHS).
The new bean module was evaluated using on-station trials results at Melkassa and Bako in Ethiopia. At Melkassa, maize and bean crops as sole and intercrops under CA and conventional tillage were grown in 2010 and 2011 seasons. At Bako, maize-bean intercrops under CA with 3 levels of N inputs (0, 64, 110 kg N/ha) were grown in 2011 season.

The key results at Melkassa were:

- At Melkassa, the calibrated version of the bean module was able to remove the over-prediction of bean yields for the intercrop, without greatly affecting the prediction of sole bean yields across two seasons (Fig 2).
- There was corresponding dramatic improvement in simulation of intercropped maize yields, although there was still under-prediction associated with the zero till treatments with mulch applied (i.e. simulated immobilisation effects).

Figure 1. Observed and predicted maize yields for on-farm trials at Kakamega (LHS) and simulated biomass accumulation for intercropped maize-bean at Kakamega using released (5_400) and calibrated (20_50) Bean module (RHS).

Figure 2. Observed and predicted maize and bean yields at Melkassa for released (LHS) and calibrated (RHS) bean module.
The key results at Bako were:

- the calibrated Bean module improved the RMSD for intercropped bean yields from 280 kg/ha to 125 kg/ha. There was slight improvement in simulated maize yield.
- Very high maize yields were observed at Bako relevant to the intercrop bean yields (Fig 3) and the graph masks the bean simulation results.

Using the calibrated bean module at Embu, Kenya, under-prediction of intercropped maize yields was removed, but there were still large disparities between simulated and observed bean yields. For example, simulated bean yields in the dry 2010 October rains is grossly over-predicted for both sole and intercrop beans. At the same time, high observed bean yields (sole 1.4t/ha, intercropped 0.75 t/ha) in April rains 2011 were under-predicted by the model while much lower bean yields for an equally good season in October rains 2011 were well predicted. A clear understanding of the variations in the observed yields is not yet at hand, but recent examination of radiation data for the test seasons may be partially responsible for the simulated results. A further task is to re-visit simulations of the Kakamega on-farm results using the calibrated bean module (and more realistic soil depth inputs for the bean simulations).

**Evaluation of APSIM to simulate crop responses in conservation agriculture systems: Season and site effects.**

SIMLESA has embarked on an extensive experimentation program to assess the longer-term benefits of conservation agriculture (CA) compared to conventional tillage systems. There is an expectation that short-term yield benefit from water conservation will also accrue from CA systems in rainfed systems. To extrapolate and analyse these short-term effects on crop growth across seasons and sites, a tested and calibrated APSIM model is required.

In September 2012, project agronomists participated in a modelling workshop at CIMMYT, Harare. Yield results from 6 on-station trials for up to 3 cropping seasons were presented and along with climate, soil and management data, used to evaluate APSIM’s performance in simulating the observed crop responses for CA and Conventional tillage systems. To assess the observed results, crop yields across sites were plotted against an environmental index (EI), calculated as the mean of all treatment yields in a season, at each site. In breeding, the EI is used to identify higher and lower yielding varieties relative to the EI benchmark.
The key results were:

- No short-term yield benefits were evident for CA compared to conventional plough (CP) treatments, even when very low rainfall was experienced in several seasons (e.g. maize yield < 2 t/ha in Fig 1.).
- CP treatments tended to out-yield the CA plots where significant amounts of maize residues were added, and at high maize yields, intercrop bean yields were low compared to sole bean (see RHS in Fig 1).
- APSIM-Maize and the newly calibrated Bean module performed well in simulating observed maize yields across sites for sole, intercrop and rotation crops under CA and CP systems. Measured grain yield varied from 0.1 to 8.3 t/ha and the RMSD for observed and predicted results was 1055 kg/ha).
- The calibrated APSIM-Bean module did not perform as well, with a bias to under-predict higher bean yields at Melkassa and a bias to substantially over-predict sole bean yields in a dry season at Embu. Very low pigeonpea yields at Selian in a drought season were reasonably well predicted.
The task now for project agronomists is to apply APSIM to evaluate longer term soil benefits of CA systems (changes in soil organic carbon, soil loss) and cropping and nutrient options to effectively utilise high C:N maize residues.

**Evaluation of APSIM to simulate maize responses in conservation agriculture systems: Water conservation and interactions with N**

Long dry spells are a major hazard for crop production in rainfed systems and improved soil water capture (reduced runoff) and retention (reduced soil evaporation) is expected under CA systems where crop residues are retained on the soil surface. Nevertheless, crop benefits from water conservation in CA systems will vary with seasonal rainfall conditions and interact strongly with soil N supply. The dynamic nature of these interactions can make the task of interpreting experimental results difficult, but may be assisted by well tested crop simulation models.

On-station trials at Chimoio and Chitala experienced severe dry spells in 2011/12 (Fig 1 and Fig 3). Trial results are used to evaluate APSIM’s performance to simulate observed maize responses where inputs of N (Chitala) and surface mulch (both sites) were varied for conventional and conservation tillage systems. APSIM was calibrated (soil N inputs mainly) to the baseline Conventional Till treatment at each site and then tested to simulate the tillage and mulch effects on maize growth in the CA systems.
Key results at Chimoio are:

- Maize yields (1.5t/ha, Fig 2) were clearly affected by the dry spells, given in-crop rainfall was 590mm, and all treatments received 110 kg N/ha.
- There was no yield response to applied mulch (2t/ha on CA treatments) or basins to capture rainfall.
- APSIM reproduced the observed yields very closely (Fig 2), except for Jab planter where there was a poor plant stand and root (speculated) growth effects.
- Model outputs on soil water balance showed Basin treatment did conserve soil water by reducing runoff by almost 50%.
- Model applications using 61 years of climate data at Chimoio showed that the observed yield outcomes could be expected in 5% of seasons, that benefits from mulch accrue in 11% of seasons, but negative effects of mulch due to N immobilisation (~360kg/ha) were much more likely (84% of seasons).

Key results at Chitala are:

- N fertiliser rates were applied very late and helps explains the lack of maize response to N inputs.
- Maize yields for Conventional plough plots were significantly higher than CA plots (p<0.05), but there was no response to increasing mulch rates for either tillage treatment.
- APSIM simulated the non-response to late applied N for the CP and CA treatments without mulch. However, in this very dry season, APSIM simulated a response to N rates where mulch was applied (Fig 4.).
Fig 3. Rainfall at Chitala. Malawi, in 2011/12 season (flowering approx 55 das)

Fig 4. Observed and predicted maize yield for tillage (CP and CA), nitrogen (0, 30, 60, 120 kgN/ha) and mulch (0, 2, 4, 8 t/ha) treatment combinations at Chitata

APSIM is a point source model and trial results are from very large plots where soil variations are likely. Initial conditions for water and soil N may need to vary across treatment plots to improve model predictions.
Overview

Between July 10th and July 18th, 2014, two participatory crop modelling (PCM) workshops were conducted by Solomon Hassen and John Dimes at Adami Tulu and Awara Gama in the central and southern Rift Valley of Ethiopia, respectively. The workshops were an initial farmer engagement activity as part of Solomon’s PhD studies at the University of Queensland. Each PCM exercise consisted of two workshops – (i) an initial farmer engagement to gather information on cropping systems, field and maize management and production constraints and (ii) a feedback session to present results of analysis of day 1 information and selected model applications. Approximately 40 farmers, 5 Development Agent officers and 2 MARC scientists attended the workshops and both farmer groups comprised of farmers active in the SIMLESA on-farm and scaling out activities.

In May 2012, PCM workshops showed that farmers undertake multiple tillage events at Bofa (5-6) and Adami Tulu (3-4) to prepare their fields for maize plantings in the Rift Valley (and even more for Tef fields, planted mid-to-late July). The high tillage frequency is attributable to the lengthy (Feb-May) and substantial (>250mm on average) but highly erratic rainfall distribution of the Belg season whereby cropping options are too risky but unfretted weed growth demands some form of control. At the same time, farmers are encouraged by some April-May rainfall events (and perhaps a desire to halt further tillage operations) to plant maize early, only to have post-sowing dry spells necessitate re-sowing. Results of the 2012 workshops also showed that the Rift Valley regions are highly responsive to N inputs, but farmers invest very little in top-dress fertiliser, especially at Adami Tulu. Two questions therefore arise from these former workshop observations: (1) Can better
understanding of the pre-season rainfall regime and soil water balance for alternative land management technologies (CA, CP) enable rules to be developed that help farmers better identify and exploit early sowing opportunities for maize production (along with any implications for N inputs for longer duration crops), and (2) Can the Belg season rainfall be utilised by short duration legume options (forage or grain) to provide a ground cover crop that reduces tillage frequency while enhancing the soil N supply capacity to a following maize crop.

Workshop purpose

1. Document farmers current maize planting rules under contrasting rainfall environments in the Rift Valley (Adami Tullu, Awara Gama- in Shalla district)
2. Establish farmers' tillage frequency during the Belg* season to prepare maize seedbed
3. Explore with farmers, alternative weed control options for the pre-season
4. Share model analysis results on maize yield benefits following legume cover crops in pre-season and canvass farmer reactions to this technology innovation
5. Explain proposed PhD experimental programme and initiate farmer collaborations for on-farm experimentation in 2015

(* Farmers at Adami Tulu did not know the term "Belg". Used 'pre-season' in its place)

Adami Tulu Activities:

A. Preparations: July 9th- sourced 2014 rainfall from ATARC, prepared daily rainfall charts
B. Adami Tulu Day 1 Workshop (Thursday July 10th)
   1. Re-cap modelling analysis results from May 2012 workshop (8 farmers attending)
      a. Population effects on maize yield
      b. Field age and SOC effects on maize yield
      c. Effects of additional and earlier weeding on maize yield
      d. Effects of top-dress N application on maize yield
      e. Highlight farmer question at end of 2012 workshop – “Compare early and late sowing of maize”
   2. Solicit farmer practice change following 2012 workshop
   3. Survey farmers (20) on number of fields, total cropped area and livestock numbers
   4. Canvass maize planting windows, rules for sowing and cultivars sown
   5. Conduct field management exercise (Fig 2) for 2014 pre-season and planting period (for up to 4 fields)
Figure 2. (a) Farmers allocating coded stickers to describe the timing of tillage, maize and bean sowing and weeding operations during 2014 season, and (b) Results for Field 1 (of 4) at Admai Tulu, along with daily rainfall (from ATARC) for Jan 1 to Jun 25th, 2014.

C. Adama (July 11 & 12th). Process and summarise Day 1 data and model applications
   (i) 2012 farmer question
   (ii) Effects of cultivar selection x planting window
   (iii) Maize yields benefits following forage legume in Belg season

D. Adami Tulu Feedback Workshop – Sunday July 13th (farmer’s timing choice)
   1. Collect data on Maize cultivar x sowing date for fields in 2014
   2. Present summary results from Day 1 and document farmer feedback
      a. Cropped area and livestock numbers
      b. Sowing windows, cultivars listed and expected crop duration
      c. Summary of field management results in 2014
   3. Present Modelling Results
   4. Discussion on tillage costs and strategies to reduce costs (CA, pre-season cover crop)
   5. Present proposed PhD experimentation and canvass farmer reactions
Awara Gama Activities:

A. Preparations:
   July 14th - sourced 2013 and 2014 rainfall for Hawassa from Solomon Admassu, prepared daily rainfall charts for 2014 season for Day 1 workshop.
   July 15th – sourced SIMLESA on-farm rainfall records for 2012 and 2013 for model applications

B. Awara Gama Day 1 Workshop (Tuesday July 15th) -
   1. Survey farmers (18) on number of fields, total cropped area and livestock numbers
   2. General discussion on cropping systems, management and constraints to production
   3. 5 farmers selected to do farm resource allocation mapping in 2013 season (to calibrate modelled yields and guide scenario analysis)

Figure 3. (a) Farmers at Day 1 meeting doing Resource Allocation Maps for their field operations and crop yields in 2013 season, with assistance from DA and MARC officers, (b) farmers presenting their RAMs to the farmer meeting during the Feedback session

4. Remaining farmers participated in field management exercise for 2014 pre-season and planting period (for first maize and first bean fields planted)

C. Hawassa (July 16 & 17th). Process and summarise Day 1 data, update APSIM climate file for Hawassa*, insert on-farm rainfall for 2012-13, summarise RAMs, model applications.
   [*On Day 1, farmers confirmed Hawassa was more similar to Shalla climate than Arsi Negelle (in Australia had been using Arsi Negelle for Shalla)]
Modelled scenarios

(i) RAMs #2 – this farmer had purchased 350kg DAP in 2013 (application rate =100kg/ha for maize and bean production). What if she split her investment between DAP and Urea for maize applications? As Urea is cheaper by the bag and has higher N content, does its purchase represent a better allocation of available cash resources and higher returns?

(ii) Maize yields benefits following forage legume in Belg season
   a. End forage and sow medium duration maize in normal planting window
   b. Allow longer period for forage and plant short duration maize in late window

D. Awara Gama Feedback Workshop – Friday July 18th
   1. Collect data on Maize cultivar x sowing date for fields in 2014
   2. Canvass rules for maize sowing
   3. Present summary results from Day 1
      a. Cropped area and livestock numbers
      b. Sowing windows, cultivars listed and expected crop duration
      c. Summary of field management results in 2014
   4. Introduced farmers with RAMs and presented modelling results
   5. Discussion on dry spell effects, Awara and Adami rainfall patterns, value of rainfall information
   6. Present proposed PhD experimentation and canvass farmer reactions
Figure 4. Explaining the rationale of the PhD study using legume cover crops in the pre-season (a) at Adami Tulu and (b) at Awara Gama
Key Results Adami Tulu:

1. Average in-crop rainfall at Adami Tulu (2001-2011) is 600 mm and the annual is 770 mm. Model analysis for N non-limiting conditions suggest that the water limited yield potential of maize at this site is about 7 t/ha. At the Day 1 meeting, farmers stated that 4 t/ha is possible with good management and investment in fertiliser, including top-dress. They were questioning the lower maize yield simulated by the model with urea application (3.1 t/ha) presented during the 2012 re-cap session. It was pointed out that the simulated result was using actual farmer management that was less than ideal (low population, late sowing). However, what this exchange does show is that farmers have an understanding of the benefits of top-dress fertiliser at Adami Tulu, but choose not to use it.

2. On average, farmers perform 3 tillage operations per field in the pre-season plus one at sowing. The cost for contract ploughing is B600/0.25 ha. For each 1 ha field the nominal cost of tillage for maize plantings is therefore B2400/year. Average cropped area at Adami Tulu is approximately 3 ha (Fig 5). The survey results show that land holdings are larger at Adami Tulu than Awara Gama, and that livestock numbers (and therefore dry season feed requirements) are substantial (mostly 5-10 or greater) at both locations.

![Figure 5. Frequency distribution of total livestock numbers (cattle, goats, donkeys) and cropped area for farmers at Adami Tulu (bottom) and Awara Gama (top).](image)

3. Results for sowing window x cultivar selection suggests farmers are mostly insensitive to the planting date in selecting the maize cultivar, or have specific reasons (green maize) for sowing very short duration maize at the earliest sowing event (PhD results).

4. Farmers’ questions on use of forage legume in pre-season suggests that they understood and were interested in the new management strategy (Fig 6). They were also enthusiastic about cooperating in establishing field trials in the 2015 season to test options to reduce tillage毅耐镁。
5. The May 2012 PCM workshop had found that no farmers at Adami Tulu use top dress fertiliser. (This was confirmed by Abeya’s farmer survey in Sept 2012). However, no farmers had adopted urea applications following the 2012 workshop. This may be attributable to a lack of any follow-up on-farm experimentation to confirm the modelling results and reinforce farmer learning. There were no SIMLESA resources available to do so at the time and there was no inclination to re-prioritise the existing CA focus.

6. Model analysis of a CA option (i.e. no weed growth and mulch with low C:N ratio to conserve soil moisture but not decrease soil N supply) at Adami Tulu showed no maize yield benefit compared to a scenario of 3 tillage events to control water use by weeds in the Belg. (This result is explained by the high in-crop rainfall at Adami Tulu, such that soil water at sowing has little impact on simulated grain yield). It was decided not to present this result to the farmer meeting.

As there were a number of farmers present who had hosted SIMLESA trials or had participated in scaling out activities, it was decided that the farmers would have sufficient experience to discuss the relative benefits of herbicide use to control pre-season weeds. However, this discussion revealed that no farmers were practicing CA on their own fields (this is consistent with results of field mgmt. exercise). They indicated that the herbicides were not available locally (Fig 7).
Figure 7. Results of discussion with farmers about CA as an option for cheaper weed control. The information suggests that farmers are actually not in a position to answer this question.
Key Results Awara Gama:

1. Average in-crop rainfall at Hawassa (Awara Gama) (2002-2013) is 600 mm and annual is 1011 mm.

2. At the Day 1 workshop, farmers nominated rainfall variability as the highest constraint to maize production, followed by input availability and access (Fig 8). Equal next was decreasing land holding with increasing family size and labour shortages.

3. Comparing Adami Tulu and Hawassa monthly rainfall patterns during the Feedback workshop convinced farmers that rainfall per se was not the most limiting constraint at Awara Gama (Fig 9). They then nominated poor management skills and knowledge in its place.
Figure 9. Average monthly rainfall for Hawassa (representing Awara Gama in Shalla) and Adami Tulu.

4. No farmer had a rain gauge at Awara Gama (same applies at Adami Tulu) and local researchers informed the meeting that the Ministry of Agriculture (and/or Met?) is the only source for rain gauges in Ethiopia. A visit to the Agricultural Office in Shashemane revealed that they also do not collect rainfall data.

5. Model results:
(i) Splitting fertiliser investment between DAP and Urea gave an average maize yield increase of 660 kg/ha and a reduced cost outlay compared to DAP only (Fig 10).

(ii) A lablab cover crop in pre-season with maize sown with normal window, cultivar and DAP application gave an average yield almost equal to the urea application while providing a high quality seasonal feed source of about 1.5t/ha (Fig 11).

(iii) Allowing the lablab to grow longer and plant a short duration maize cultivar in a later planting window, increased average maize yield by 600 kg/ha compared to the urea option (data not shown) and increased feed supply to 3.5 t/ha (Fig 11).
Figure 10. Farmer management and yield in 2013 for field sown to maize (at top) and simulated yields (bars) for the same management (100kg DAP/ha = 18kgN/ha) across the previous 11 seasons. At bottom (in green) are simulated yields if split the fertiliser investment between DAP and Urea (32 kgN/ha applied).

Figure 11. Simulated grain yield at Awara Gama (2002-2013) for maize sown in the normal sowing window (Apr 10-May 5, Ethiopian dates) following Lablab sown in Jan-Feb. The Lablab biomass yield at maize sowing is at bottom of graph (in green). The average lablab yield increases from 15 to 35 Q/ha if the lablab is grown to May 15th and a short duration maize cultivar is sown between May 15 and Jun 15th.

The RAMs provided detailed management on 14 fields in 2013 (7 maize, 5 bean, 1 millet and 1 tef). Twelve fields (maize and bean) received DAP while 3 maize fields received urea. The highest maize yield was 60Q/ha with urea. The other 2 urea fields had yields of 4.5t/ha and 3.5t/ha. The highest maize yield with DAP (100kg/ha) was 5t/ha, with the remainder less than 3.5t/ha. A noticeably large
variation in soil depth along roadsides in the area is likely to have played a part in these yield variations, along with management variations.

A total of 22 bags of DAP was purchased by the 5 farmers in relation to the 14 fields, whereas 3 bags of urea was purchased. Hence the average investment in DAP:Urea is roughly 7:1. The fertiliser recommendation for the Rift Valley, as used in the SIMLESA trials (i.e. 100 kg DAP + 50 kg Urea / ha) has a ratio of 2:1.
1. Introduction

The Sustainable Intensification of Maize-Legumes based Cropping Systems for Food Security in Eastern and Southern Africa (SIMLESA) focuses on 5 countries in Africa – Ethiopia, Kenya, Tanzania Malawi and Mozambique – with spill overs in another 5 neighboring countries (Rwanda, South Sudan, Uganda, Botswana and Zimbabwe). The program funded by Australian Centre for International Research (ACIAR) and executed by International Maize and wheat Improvement Center (CIMMYT), aims to improve the maize and legume productivity by 30% and to reduce the expected downside yield risk by 30% on approximately 500 00 farmers within 10 years. Through participatory research and development with farmers, extension agencies, non-governmental organizations, universities and agribusinesses along the value chain with the support of sub-regional research organizations and existing networks the program foster spill overs of improved crop systems management practices and improved germplasm.

The capacity building component of the SIMLESA program aims to increase the efficiency of agricultural research. The program focuses not only on short-term training but also long-term to build capacity amongst the present and future generation of agricultural scientists. The capacity building program intends to increase the understanding and knowledge of CA principles including pest and disease management as well as skills required for data management and analysis; and participating and managing Innovation Platforms.

The Agricultural Research Council (ARC), as one of the capacity building partners for the SIMLESA program, has more than 200 training courses across the agricultural value-chain. The courses are constantly being updated as new information becomes available. Training courses for SIMLESA scientists and extension personnel were custom designed to accommodate the expressed needs of each country or group of trainees from different countries. For in-country training, ARC experts travel to those countries to conduct practical training. In-house training involves travelling of participants from different countries to ARC in South Africa. The interactive learning approach was the major style of learning utilized during the training, which has proved very effective.

2. Capacity Building Workshops

In the 3 years of the partnership between the ARC and the SIMLESA program, all target countries were visited and capacity building needs identified together with the country coordinators. A total of 93 scientist from10 different countries were trained in the period July 2013 to March 2014 (Table 1).

2.1 In-house Agronomy Workshop (May 2013)

An in-house training programs were conducted at ARC in South Africa May 2013. The focus of this training was on agronomy for young scientists. Modules for these training programs were: applied principles of biometry, conservation agriculture, soil health and innovation platforms. In-house training afforded an opportunity to identify similar capacity challenges in the different countries and have participants share experiences on how to tackle them. Participants had an opportunity to tour some ARC facilities relevant to their work in Pretoria and Potchefstroom; visit agribusiness specializing in conservation agriculture products and implements and also attended National Maize Producers Organization (NAMPO), one of the largest machinery and livestock agricultural show in the southern hemisphere.

2.2 In-house Science Communication Training (3-8 March 2014)
10 SIMLESA Scientists were invited to a Science Communication Workshop on the 3-8th March 2014. The Science Communication workshop was hosted by Beastenough, a service provider of the ARC specializing in Science Communication, Public Understanding of Science, Video Production and Journalism. The focus of the workshop was to assist the Scientists produce a SIMLESA Kit, composed of 6 articles (according to SIMLESA’s 5 objectives), Video Clips, Policy Recommendation, and SIMLESA Magazine. The SIMLESA Kit was presented to the Annual General Meeting in Addis Ababa, Ethiopia on the 7th April 2014. The SIMLESA Kit composed of the following:

2.2.1 SIMLESA Magazine 2010-2014
2.2.2 Article 1: Bridging the gender gap within SIMLESA countries
2.2.3 Article 2: Farmer-preferred maize varieties released to enhance food security in Eastern and South Africa
2.2.4 Article 3: Legumes for Food, Nutrition, Income Security in ESA
2.2.5 Article 4: Conservation Agriculture Technologies help increase yields and save on labour costs
2.2.6 Article 5: SIMLESA technologies spill over to other countries
2.2.7 Article 6: SIMLESA Improving Africa’s Capacity for Sustainable Agricultural Development and Food and Nutrition Security
2.2.8 Article 7: Nurturing Innovation Platforms and empowering smallholder farmers
2.2.9 Article 8: Policy Brief: Sustainable Agricultural Intensification Through Multi-technology Adoption: A Regional Overview from East and Southern Africa
2.2.10 SIMLESA Video Clips

2.3 In-country training workshops
These were held in Arusha (Tanzania) and Moshi (Tanzania). The focus of this training was on the Principles of CA, Pest & Disease Management, Biometry, Introduction to Innovation Platforms and Extension Principles. Long-term training and Introduction to Innovation Platforms were the most popular and requested training modules. This resulted in the development of a resource book that can assist facilitators and extension officers with skills to establish innovation platforms.

2.2.2 Training in Tanzania (25-29 November 2013)
The training in Tanzania (Moshi) had 55 participants and covered the following modules:

i. Statistical Guideline module (1 day) was presented to the two groups. In general all participants find the course useful to very useful and 70% say it was clear to very clear. They would like this course to be repeated over a longer period with more practical examples. Data Analysis with Excel2010 (1.5 days) workshop was too short for all the participants and they requested that the workshop should be repeated for at least one week period. In general all participants find the course useful to very useful and 90% say it was clear to very clear.

ii. Pivot table session in the Excel2010 workshop was presented on the 29th of November 2013. 62% of the participants found the course to be clear to very clear. The course was also regarded as useful by 75% of the participants. However 75% of the participants indicated that the time allocated for the course was too short and that the length of the course should be made longer.

iii. Graphical presentation using Excel2010 workshop was presented on the 29th of November 2013. The workshop was attended by 26 participants. 87% of the participants said the aims of the workshop were made clear to them. Even though all participants (100%) found the workshop very useful and 96% were very satisfied with the trainer, more than 60% of the participants found the duration of the workshop too short. Due to the time allocated that was too short, all participants requested that the workshop repeated another time and for a longer period so that they can be confident in applying the knowledge applied to them.
iv. **Weed Management** course was presented from the 26 – 27 November to 29 participants. Topics like weed biology, adjuvants, weed management and knapsack calibration were addressed during the two day course. 100% of the participants found it useful to very useful. 75% of the candidates found it to short. The course was very interesting, particularly the calibration part which included a practical part which improved confidence levels.

### 2.4 Biometry Consultation Workshop (26-30 May 2014)

As part of the current Capacity Building contract between the ARC and CIMMYT, a request from the Programme coordinator was made to host a Biometry Consultation Week, in Harare. The aim of the Biometry Consultation week was to provide statistical services and editing of publications for 10 young scientists coming from Ethiopia, Kenya, Malawi and Zimbabwe. Ten data sets were sent 1 weeks prior travelling so that Biometricians could familiarise themselves with it. From 26 to 30th May 2014, 13 CIMMYT agronomy scientists (1 female and 12 males) gathered at Rainbow Towers hotel, Harare for a 5 day data handling and analysis workshop to consolidate SIMLESA’s Objective 2 results obtained in the last 4 years with a view to turn these into credible scientific publications.

### 2.5 Human Capital Development

i. **One PhD candidate** (Tanzania) is registered with the University of KwaZulu Natal (Frank Mmbano). Data collection in Tanzania was finalized in February 2014. Mr Mbano is expected to finalize his write up by June 2015.

ii. **Two MSc candidates** (Mozambique) Gabriel Bragga and Custodia Jorge registered with the University of Free State. These students have since finalized their conducting field and glasshouse trials at the Grain Crops Institute (Potchefstroom campus). Analysis of data and compilation of their theses is expected to continue until December 2014.

### 3. General comments

An enormous need for training still exits. Participants are very grateful and participate enthusiastically in all activities, however, it’s clear that most of them are struggling with basic concepts especially in Biometry and therefor extended training has been requested. The training provided always includes elements of extension methodologies; this is to assist the scientists, who are tasked with training extension, to be able to do so. The Training & Advisory Unit together with ICRA partners provided the additional training in the form of modules such as: Communication; Working in teams; Managing stakeholders; Facilitation skills (how to facilitate a workshop); Science Communication (for interacting with media). These are ARC in-house courses and some of them are accredited. The courses are designed specifically for scientists to be able to deal with the different clients and multi-disciplinary teams; to be able to face the media and engage meaningfully for the public understanding of the science they produce. Most important, these additional modules enables scientists source R&D needs from their users, in this case Extension and Farmers.
Fig: 1  Knapsack calibration during Weed Management in Tanzaini November 2013 (Mike Kidson from ISCW)

Fig: 2  Plant pathology training during Agronomy Training in May 2014
Fig: 3 Visiting CA trials Potchefstroom during Agronomy Training in May 2014 (Annelie De Beer, GCI)
ANNEX 5: Ambassador's Visit to Ethiopia

Australian Ambassador Visited SIMLESA Activities in Ethiopia

The Sustainable Intensification of Maize-Legume Systems for Food Security in Eastern and Southern Africa (SIMLESA) program activities has been implemented in different parts of Ethiopia since 2010. Ambassador Lisa Filipetto, Australian Ambassador to Ethiopia, visited one of SIMLESA sites in the North-Western part of the country, implemented by Amhara Regional Agricultural Research Institute (ARARI) on November 7, 2013. The Ambassador was accompanied by scientists from CIMMYT-Ethiopian office and the Ethiopian Institute of Agricultural Research (EIAR) who are actively working on SIMLESA program. Dr. Biru Yitaferu, Director General and Dr. Likawent Yeheyis, Director of the livestock research of ARARI warmly welcomed the visiting team. Thereafter, Dr. B. Yitaferu presented highlights of ARARI missions, mandates, managerial structure, human and physical resource capacities. Dr. L. Yiheyis briefly presented an overview of SIMLESA program implementation in the region.

ARARI directors indicated that maize based farming systems in the region are characterized by monocropping, repeated tillage and residue removal which results into unsustainable production systems. Therefore, SIMLESA program which promotes reduced tillage, year round residue coverage and maize-legume rotation or intercropping is a desirable and timely program for the region. The presentations showed the extensive research and development activities being implemented under the program on conservation agriculture (CA)-based exploratory trials; farmer participatory variety selection (PVS) of maize, grain legume and forage/fodder varieties; and up-scaling of best bet technologies in South Achefer and Jabitenan districts.

A field visit was made to South Achefer, where a number of SIMLESA activities on-farmers’ fields and Abchikli farmers’ training center (FTC) are implemented. CA-based maize-grain legume intercropping, maize-forage/fodder crops relay cropping, PVS trials of hybrid and open-pollinated maize varieties, and sweet lupine varieties were visited. Four of the sweet lupine varieties being evaluated in the PVS trials are under the process of release for commercial production. Accordingly, the varieties have already been visited by the National Variety Release Committee, and hopefully two of them will be released.

SIMLESA hosting communities are exposed to new crop varieties and production practices. Newly released and pre-release varieties of maize, legume and fodder/fodder crops are used in all PVS trials. Integrated maize-grain legume and maize-fodder/fodder cropping practices have been newly introduced to the region by SIMLESA program. Farmers in the areas who have been practicing maize monocropping over the last many years highly appreciated the new practices. The practices helped them to get additional harvest from their plots without significantly affecting the maize yield while replenishing soil fertility. As reported by Dr. L. Yeheyis, Amhara regional government bureau of agriculture has decided to include CA practice, and maize-legume intercropping and maize-fodder/fodder relay cropping practices in the regular extension program. This will significantly contribute to an increased adoption of SIMLESA technologies among wider range of farming communities in the region.

At the end field visit, Ambassador Lisa Filipetto expressed her appreciation of the extensive work being implemented in the country under SIMLESA program.
TABLE 1: Training Conducted in 2013/14

<table>
<thead>
<tr>
<th>MODULES</th>
<th>VENUE</th>
<th>COUNTRIES TRAINED</th>
<th># TRAINED</th>
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<tr>
<td>In House Training</td>
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<tr>
<td>CA, Weed management, Pest &amp; disease management, Stats, Introduction to IP, soil nutrition management</td>
<td>Potchefstroom</td>
<td>Young scientist from Mozambique, Rwanda, Kenya, Malawi, Tanzania, Ethiopia, Uganda,</td>
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<tr>
<td>Science Communication Workshop: Personal Grooming, Dealing with Media, Writing Media Brief; Science Writing Tools; TV Interviews</td>
<td>Hatfield</td>
<td>CIMMYT Senior Scientists and Country Coordinators from: Ethiopia, Kenya, Malawi, Tanzania, Mozambique, Zimbabwe, Rwanda &amp; Uganda</td>
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</tr>
<tr>
<td>In Country training</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Statistical Guidelines; data analysis using EXEL and Weed Management</td>
<td>Moshi</td>
<td>Tanzania</td>
<td>55</td>
</tr>
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<td>Biometry Consultation</td>
<td>Rainbow Hotel</td>
<td>Harare</td>
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<tr>
<td>Post Graduate Training</td>
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<td>Mr Frank Mmbano (Tanzania)</td>
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<tr>
<td>Masters in Agronomy</td>
<td>University of the Free State</td>
<td>Mr Costodio Jorge &amp; Gabriel Braga (Mozambique)</td>
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