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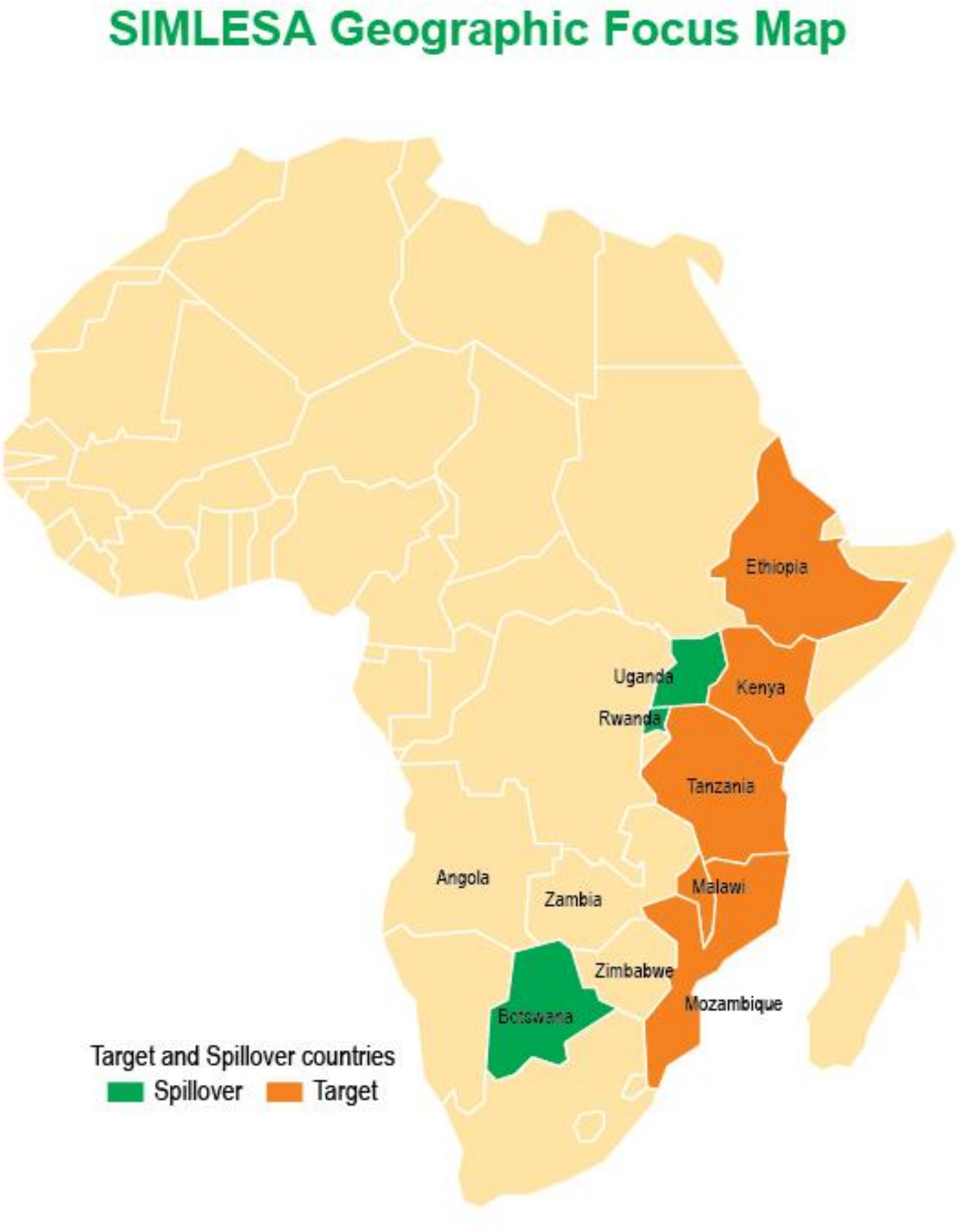
Prepared by	*Dr Mulugetta Mekuria (Program Coordinator)*
-authors/ contributors/	*Gift Mashango (Project Manager), Johnson Siamachira (Communications Specialist) and Sebastian Gavera (ME & L Specialist)*
Collaborators	Department of Agricultural Research Services (DARS), Malawi Mozambique's Agricultural Research Institute (IIAM) Department of Research and Development (DRD), Tanzania Kenya Agricultural and Livestock Research Organization (KALRO) Ethiopian Institute of Agricultural Research (EIAR) Agricultural Research Council (ARC), South Africa Queensland Alliance for Agriculture and Food Innovation (QAAFI), Australia Association for Strengthening Agricultural Research in Eastern and Central Africa (ASARECA) International Center for Tropical Agriculture (CIAT) International Livestock Research Institute (ILRI)
Approved by	*Dr John Dixon*

SIMLESA target and spillover countries



Acronyms

ACIAR	Australian Centre for International Agricultural Research
AGRA	Alliance for a Green Revolution for Africa
AGRIMERC	Organisation for Sustainable Development of Agriculture and Rural Markets
AIFSC	Australian International Center for Food Security
APSIM	Agricultural Production Systems Simulator
APSFarm	Agricultural 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 and 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 Center
IARC	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
KALRO	Kenya Agricultural and Livestock Research Organisation
LER	Land Equivalent Ratio
MARC	Melkassa Agricultural Research Center
MASA	Malawi Seed Alliance
ME&L	Monitoring Evaluation and Learning
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-Legume Based 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

This semi-annual progress report is an outline of activities under the Sustainable Intensification of Maize-Legume Based Cropping Systems for Food Security in Eastern and Southern Africa (SIMLESA) program for the July to December 2016 reporting period. The SIMLESA program is being implemented in five main countries – Ethiopia, Kenya, Tanzania, Malawi and Mozambique. The program, in its second year of the second phase - utilizes pathways for the intensification of maize-legume based cropping systems through the promotion of resilient and adopted technologies. Funded by the Australian Centre for International Agricultural Research (ACIAR), SIMLESA was launched in March 2010 and is a multi-stakeholder collaborative research program managed by the International Maize and Wheat Improvement Center (CIMMYT) and implemented by National Agricultural Research Systems (NARS) in the core countries, with backstopping inputs from other partners. Botswana, Uganda and Rwanda are spillover countries benefitting from ongoing SIMLESA research activities, (See map on page i). The program is working with a wide range of collaborators[1]

The program aims to create more productive, resilient, profitable and sustainable maize-legume farming systems that overcome food insecurity and help reverse soil fertility decline, particularly in the context of climate risk and change. The program is helping farmers to diversify their crops, increase food production, and withstand the risks of climate variability and drought. SIMLESA is envisaged to reach 650,000 small farming households in the five countries over a 10-year period. The second phase of the program (SIMLESA II) was launched in July 2014 with modified program objectives and emphasis on scaling out evaluated technologies.

Notable activities and achievements during the reporting period

The Adoption Monitoring Survey of 2016 revealed that the estimated number of farmers adopting CA-based sustainable intensification (SI) technology based on the 2015/2016 season adoption rates was 61,889 farmers with a gender disaggregation of 43,400 males (70%) and 18,489 females (30%)[†]. These estimated smallholder farmers adopted SI based technologies through field days, exchange visits, innovation platforms, demonstration plots and farmer trainings.

As of December 2016, the SIMLESA program had witnessed an average yield increase of 30-60% from conservation agriculture-based SI exploratory on-farm and on-station trials which have varied results from one region to another. This resonates very well with the program aim of increasing productivity by at least 30% since the inception of the program in 2010. Evidence of increase in maize yield at country level has been witnessed in all SIMLESA countries, particularly in Ethiopia (Bako, Southern Region and Central Rift Valley). In these areas, yield has increased from 2.0 tons per hectare at the start of the program, to an average of 7.0 tons per hectare. In Tanzania, farmers realized increased yields from 2.5 to 4 tons per hectare in maize and from 1.5 to 3 tons per hectare in legumes through drought tolerant crops from conservation agriculture based SI practices compared to other farming practices. There were labour savings by 50% on time for other economic activities through adopting zero tillage which in essence has also led to reduced cost of production.

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[1] Collaborators of the program include: Association for Strengthening Agricultural Research in Eastern and Central Africa (ASARECA), Agricultural Research Council (ARC) of South Africa, Queensland Alliance for Agriculture and Food Innovation (QAAFI), International Center for Tropical Agriculture (CIAT) and International Livestock Research Institute (ILRI).

[2] The estimation of the adoption monitoring figures based on the 2016 Adoption Monitoring Survey is articulated under Objective 1 of this report

In addition, local innovation platforms, which at the time of reporting had a cumulative figure of 59, have been strengthened and are functioning in the SIMLESA countries as farmer groups, partners and other key stakeholders shared knowledge on good agricultural practices, market linkages and value chains. This ensured that on the minimum, the smallholder farmers got value for money for their produce. In Western Kenya there are plans to value add the produce from the farmers through the innovation platforms approach and facilitating synergies with other like-minded organizations. During the period under review, one SIMLESA supported PhD student, Nacimento from Mozambique and 2 MSc students completed their studies. QAAFI and SIMLESA NARS partners conducted trainings on utilization and awareness of the SIMLESA SMS platform in Kenya and Tanzania.

ARC supported PhD student from Ethiopia has started his field research in SIMLESA Ethiopia study sites. To ensure effective communications, the SIMLESA website was revamped and updated to reflect the breadth of program activities and achievements, in addition to producing the SIMLESA Bulletin in September 2016 and an updated SIMLESA flyer in December 2016. Other multimedia publications were also developed and produced.

Details of program activities by objectives and country-by country constitute the bulk of this semi-annual progress report where monitoring and evaluation, gender integration, training, communications and documentation, are part of the report. The report goes further to articulate SIMLESA impacts, problems and opportunities. Rolling out of Competitive Grants Scheme for scaling-out SIMLESA technologies under Oobjective 4, is one of the critical milestones in the current reporting period. Details of the progress are articulated in subsequent sections in this report.

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

During the reporting period, Under Objective 1, all the five SIMLESA countries were involved in Adoption Monitoring Surveys but were on different stages of progress in terms of analysis and report writing. Most countries finished data collection except Ethiopia in two sites - ARARI and Bako, where data collection could not be implemented because of political instability in that country. In Tanzania there are sites whose data collection had been planned for 2017. Data was only collected in Karatu and Mbulu districts.

In all the five countries carrying out Adoption Monitoring Survey, proper statistical sample size calculations were done based on a 95% confidence level. The sample sizes were then stratified according to gender, depending on type of society. A factor of 15% female headed household was used in patrilineal societies while a proportion of 35% for female households in matrilineal ones. The sample sizes and identified adopters were used to calculate the adoption rates which were further disaggregated according to gender. The identification of households participating in the survey was done using snowball/chain sampling technique until the required sample sizes were achieved. Using district population figures from the Census offices, the adoption rates were used to estimate the total number of adopters in a ward or county/district.

The sites which were covered in Ethiopia - Central Rift Valley, Southern Region and Pawe engaged 301, 200 and 113 households respectively, giving a total of 614 households which were assessed. The data has been analyzed and report writing is in progress. The preliminary results based on adoption rates showed that 13, 367 farmers had adopted CA-based SI technologies with a gender distribution of 11, 395 males (85%) and 2,173 females (15%) implying that there is still need to advocate and promote women participation in adopting SIMLESA technologies. The Ethiopia adoption rates were found to be 56.9% (Males), 39.8% (Females) and the overall adoption rate was found to be 54.1%.

In Kenya, the Adoption Monitoring Survey results show that management practices (furrows/ridges, minimum/zero tillage and residue retention) were popular with farmers particularly in Eastern Kenya (Embu, Meru and Tharaka Nithi) while rotation and intercropping was popular in Western Kenya (Bungoma and Siaya). The extrapolation of the adopters based on the adoption rates revealed that 19,807 smallholder farmers had adopted at least one CA-based technology with a gender distribution of 11, 850 males (59.8%) and 7, 957 females (40.1%). A comparison of these results with 2013 Adoption monitoring survey shows a significant increase in women participation in SI technology.

In Tanzania, the Adoption Monitoring Survey indicated that 2,224 farmers (1, 819 males and 405 females) and 845 farmers (745 males and 130 females) in Karatu and Mbulu respectively had adopted at least one CA-based technology based on the 2016 adoption rates. Female participation (27%) in the adoption of CA-based SI technologies is still low. Among the adopted technologies, maize-legume intercropping is the most popular technology (39%) followed by zero tillage (24%) then crop rotation (15%). Adoption monitoring surveys could not be done in other SIMLESA sites in Tanzania. Plans were put in place to have the remaining sites covered in 2017.

In Malawi, the Adoption Monitoring indicated that an estimated 13, 458 households (9, 236 males and 4,222 females) in the six SIMLESA districts had adopted at least one SIMLESA technology. Further analysis of the results revealed that the most popular technology for male headed households was residue retention in Balaka, Mchinji, Ntcheu and Salima (50%, 27%, 20%, 20% and 21% respectively) followed by herbicide and hybrid use. For female headed households, residue retention was the most adopted for Balaka, Lilongwe, Mchinji and Salima (23%23%, 26% and 29% respectively). In Ntcheu the most popular adopted technologies by female headed households was herbicide use in minimum tillage fields. Technologies such as intercropping and crop rotations were adopted by fewer household across all districts. In Mozambique, preliminary results of the adoption estimation have shown that 11, 998 smallholder famers have adopted at least one of the CA- based SI technologies with a gender distribution of 8, 386 males (77%) and 3, 602 females (23%) with the use of improved maize varieties as the most popular technology for adopting. Women participation has increased particularly in Angonia District. Farmers chose to use i) drought tolerant and early maturity maize varieties such as PAN53, Matuba, ZM523, and K2- Pristine 601 to obtain a relatively higher yield compared to local varieties, ii) drought tolerant crops and intercropping of crops, combination of crop varieties, iii) residue retention and water conservation practices.

In one of the spillover countries, Uganda, activities to address Objective 1 were done through Agricultural Innovation Platforms (AIPs). Previously an AIP was launched in Kalongo sub county, Nakasongola District. During the reporting period, besides AIP monthly meetings facilitated by the Uganda-SIMLESA program staff, the following were undertaken:

- Orientation and mentoring sessions were conducted for business modelling consultants
- Workshop was conducted to assess the supply and demand for business and commercial services in Nakasongola District
- Business model analysis among purposively selected private sector key actors

The business model analysis has helped to understand the business atmosphere in the district. The analysis revealed that private entrepreneurship has the potential to contribute significantly to the adoption and scaling of research technologies.

QAAFI

Farmer interviews in Mozambique identified simple changes in agronomy (sowing date, plant densities, earlier weeding) that allow intensification of maize production-based on farmer knowledge of local best practice. Interventions were analyzed for seasonal risk with APSIM. A journal article is being prepared for publication.

The APSFarm-LivSim model was parameterized to simulate different qualities of feedstock in collaboration with ILRI. The model showed sensitivity to changes in feedstock quality and quantity. At the moment, QAAFI is waiting feedback from ILRI to define simulation scenarios for livestock intensification. The report is expected by July 2017.

Objective 2: To test and adapt productive, CA-based intensification options for sustainable smallholder maize-legume production systems.

During the first four years of implementation (2010-14), major activities in SIMLESA focussed on establishing on-farm and on-station experiments whose aim were to test and develop productive, resilient and sustainable maize-legume systems well adapted to each country's socioeconomic, agro-ecological and cultural environment.

This section briefly outlines the progress made during the review period:

SIMLESA-Mozambique organized inputs and materials for 30 modified exploratory trials with three new varieties to test compatibility with CA for the 2015/16 season. Each trial consisted of 1,200 farmers. The new varieties are two hybrids (Pristine and Molocue) and one OPV (ZM309). Results obtained showed no interaction between variety and cropping systems thereby suggesting that the varieties used responded more to the environment than to CA. The hybrid drought tolerant (DT) variety Pristine consistently outyielded the other DT varieties across all locations in Mozambique. ZM309, an open pollinated variety also consistently yielded the least.

In Angonia, trials implemented also included the CA on raised beds which continued to show promise for waterlogged soils hosted by six farmers. Yield results have already been analyzed. From the field, farmer feedback suggests that the technique is popular with farmers as they see possibility of reducing the labor burden, reduce vulnerability to waterlogging and at the same time minimize soil disturbance as the beds remain permanent once constructed.

Major activities carried out in Ethiopia included long-term on station exploratory trials, long-term on farm, evaluation of maize/legume varieties for CA-based intensification practices, trial assessments and maize/legume performance evaluations.

Most long-term trials continued as planned in Ethiopia, Malawi, Kenya and Mozambique. Modifications since 2014 varied from country to country but in most cases the on-station trials were modified to include potential CA-ready varieties while smaller basins were also incorporated as split plots in Malawi.

Selection of best bet options through exploratory trials has led to increase in crop yield. For example, in Kenya maize grain yield increased from 0.4 tons per hectare in 2010 to about 4.0 tons per hectare at the end of 2015. At the same time, the sole bean yield increased from 0.2 tons per hectare in 2010 to over 2.0 tons per hectare. The yield increase was attributed to improved field management after being exposed to SIMLESA SI technologies.

In Tanzania, the results of exploratory trials showed an improvement of maize grain yield from 0.5 tons per hectare to about 2.5 to 4 tons per hectare and 1.5-3 tons per hectare legumes yields through drought-tolerant crops from practicing conservation agriculture to other farming practices. By adopting conservation agriculture, smallholder farmers benefited from reduced cost of production while saving on labor. Farmers have saved on time by 50% for other economic activities through adopting zero tillage.

In one of the spill over countries, Uganda, a combination of PPB and rip-line tillage together with improved seed and fertilizer brought maize yield within the expected country productivity range for maize range from 3.8 to 8.0 tons per hectare.

A total of 268 and 378 maize and legume on farm Participatory Variety Selection (PVS) were conducted where best performing maize and legume varieties that met famers' preferences were selected and scaled up by partner companies. The varieties were selected based on grain yield, maturity, drought-tolerance, pest resistance and palatability. The selected hybrids yielded 30-40% more under drought and 20-25% under optimum conditions compared to commercial checks

Evaluation of long- term on-station exploratory trials confirmed that SI options gives higher yield than conventional practice across all the SIMLESA countries. In general, the practice of crop rotations of maize and legumes proved to be consistently effective across the different agro-ecologies. In the Southern regions groundnut rotations gave the highest maize yield responses under optimum conditions compared to other legumes.

In Malawi, results from exploratory trials suggest the highest yields emerging from Pan53 and MH 30 and the lowest yields from MH26 with no apparent interaction between cropping systems and variety. Yields for the first time in Kasungu surpassed the 10 tons per hectare mark, an effect attributed to good management, effective monitoring and well implemented technology. This is a milestone for the program helping to confirm that with good management (good agricultural practices) maize yields can exceed 10 tons per hectare in good rainfall seasons. The program also established four on-station trials at Chitala Research Station involving the long term experiment with new varieties, the residue *Nitrogen trial and the crop establishment trial.

QAAFI facilitated the production of a first draft soil sampling manual during the reporting period. QAAFI also carried out ex-ante modelling on the effects of residue retention and minimal soil disturbance at sites across southern Africa.

One journal article was published in the Agricultural Systems (Nyagumbo et al., 2016) addressing planting dates - http://knowledgecenter.cimmyt.org/cgi-bin/koha/opac-detail.pl?biblionumber=58043. The paper shows that CA technologies can play an important role in enabling early planting and thereby increase season length, an important attribute under climate variability. In addition, the paper confirms a significant shift in planting dates in Malawi, based on analysis of planting dates in retrospect from 30 years of recorded weather data at Chitala and Chitedze research stations.

CIAT's contributions to SIMLESA focused on improved understanding of soil nutrient and fauna dynamics in CA-based systems on sites established by the SIMLESA program as well as on sites established before SIMLESA. The bulk of the studies were carried out in Kenya while some of the activities were initiated in Mozambique and Malawi. Results from the studies suggest that CA-based systems carried out over long periods significantly increased macro faunal activity. The use of management systems using CA including residue application, contributed to increased leaching of applied nitrogen. Application of residues in conservation agriculture causes short-term N immobilization in the system (i.e., at the very early growth stages) but not later.

Soil samples for several exploratory CA trials were shipped to Nairobi from Malawi and pre-processed for chemical analysis. In addition, CIAT continued to sample and analyze soils for mineral nitrogen from SIMLESA trials in Eastern and Western Kenya as well as undertaking in-depth soil biology investigations regarding the presence and diversity of microbial, meso- and macro-fauna in additional two trials in Western Kenya (one is a six-year and the second a 13-year old trial). The data from the latter have been analyzed jointly with similar data from Eastern Kenya taken during the previous reporting period. At the same time, lysimeters to measure leachates have been installed in the six-year KALRO Kakamega trial, as well as temperature loggers in CIAT's 13-yr CA trial in Western Kenya.

CIAT also undertook soil samples at 0-5 cm, 5-20 cm and 20-50 cm depths for the mid-altitudes of Malawi for two sites, Kasungu and Mchinji specifically, for three treatments:

- conventional ridge and furrow,
- CA dibble stick no herbicide and,
- CA dibble stick maize phase of the maize-soy rotation and six farmers per community have been shipped to CIAT laboratories in Nairobi and pre-processed for analysis. The soil analysis here is from good quality on-farm trials implemented consistently over 4-5 years in southern Africa.

A trial on relay-intercropping with lablab established in Tanzania (Babati), initiated to compare with results from the trial in Mozambique, was affected by poor growth of the relays due to severe soil moisture constraints. The trial is ongoing.

Regarding residue x N interactions, CIAT continues to work together with KALRO and is undertaking sampling in two newly established trials (one in Embu and Kakamega) which offers excellent opportunity to study this aspect. In line with this, soil sampling for mineral N (including from leaching), carbon and soil functional groups analysis was conducted for the long-term trials in Western Kenya (one at KALRO-Kakamega and another at 13-yr CIAT CA trial).

Overall, a total of 59 macrofauna species classified into 15 major groups were found across the trials. The long-term trial had relatively higher species richness compared to the short-term trial, with number of species being 32 in Nyabeda and 27 in Kakamega. Previously, these had been 38 in the Embu long-term trial and 25 in Embu short-term. For mesofauna groups, 17 species classified into six major groups were observed across the four trials, and the western Kenya sites (Nyabeda and Kakamega) had relatively higher mesofauna richness compared to the Eastern Kenya (Embu) sites.

Objective 3: **To increase the range of maize, legume and fodder/forage varieties available to smallholders**

The reporting period focused on continuing with participatory variety selections. The program established experimental trials for maize and legume varieties, and supported local seed companies in scaling-out new maize and legume varieties in SIMLESA areas.

This period was characterized by continued participatory variety selections, establishment of experimental trials (trials for maize and legume varieties) and supporting local seed companies in scaling-out new maize and legume varieties in SIMLESA areas and beyond.

In Ethiopian, three annual forage species (cow pea, lablab and pigeon pea) were planted at three SIMLESA program area farmers' field to evaluate and select good forage crop in HARC. In Kenya, a total 11 varieties of the newly released and pre-released improved maize were acquired, prioritized and planted as stress tolerant under CA tillage practice (zero tillage) for the second season for testing for their environmental adaptability and farmers' acceptance

In Malawi, seven groundnut varieties released in 2014 were being promoted through on-farm demonstrations (in 2015/16 season there were 12 demonstration fields established). In Tanzania, seed productions of preferred improved varieties were carried out in 2015/2016 cropping season at ARI Ilonga and Selian. The amounts produced are shown in Table 3.1

Table 3.1 Pigeon pea pre-basic seed production at ARI-Ilonga and Selian in 2015/2016

Variety name	**Amounts (kg)**	
	ARI-Ilonga	**ARI- Selian**
Kiboko	100	100
Karatu-1	70	2500
iLonga 14-M1	100	100
Ilonga 14-M2	150	200
Sub total	**450**	**3000**
Other promising line		
ICEAP 00050		1
ICEAP 00936		90

One variety of cowpea was produced in Macate and Nhacoongo in Mozambique. The variety produced is IT 16 and it was produced on-farm by IDEEA Association (Macate) and on-station at Nhacoongo Agronomic Post. For maize, Objective 3 also worked with different seed companies to ensure seed availability during the rainy season 2016/7.

A number of meetings were held on potential drought tolerant maize and legume varieties with seed companies, ICRISAT, IITA and NGO partners. NASFAM is out scaling improved maize and pigeon pea varieties in northern Malawi. MUSECO is out scaling soybean seed multiplication, demonstration plots of improved maize and legume varieties under conservation agriculture (CA) and conventional practice imparting knowledge about CA and varieties to farmers in different areas outside SIMLESA sites.

Objective 4: To support the development of local and regional innovation systems and scaling-out modalities.

Under Objective 4, countries continued to engage the following scaling out strategies to reach out to more farmers with CA-based SI technologies: Strengthening Agricultural IPs, field days, farmer trainings – mainly organized through AIPs, including marketing/ business, exchange visits, establishment of demonstration plots, including forage species demonstrations, scaling out initiatives involving partners to conduct demonstrations of SIMLESA best bet technologies, planning meetings, development of SIMLESA's SMS delivery system and the launching and rolling out of the Competitive Grants Scheme. With these scaling out strategies, SIMLESA managed to achieve the following numbers at country level:

Table 4.1: Estimation of **Adopters of technology/practices, (Jan 2016 -December 2016)**

Country	**Farmers who have tried**		
	Male	***Female***	**Total**
Ethiopia	11,394	2,173	13,568
Kenya	11,850	7,957	19,807
Tanzania	2,534	535	3, 069
Malawi	9, 236	4,222	13,458
Mozambique	8,386	3,602	11,998
Total	43,400	18,489	61,889

***Source**: Adoption Monitoring Survey 2016*

No new IP was formed during the period under review across the other four SIMLESA countries except in Eastern Kenya where three new IPs were formed. Through partnership and collaborative research in the target countries, in line with the program design, the SIMLESA program has consistently maintained its focus on generating scientific impacts. For example, in Western Kenya, partnerships were formed with other institutions implementing similar activities focusing on CA-based SI technologies. The institutions include CIAT, County Departments of Agriculture, GIZ and other NGOs. A training on business approaches to scaling and sustainability (systems intensification) under the formed partnership is planned for early 2017. In Eastern Kenya, strengthening of the demonstration sites continued during the July–December 2016 reporting period. The following activities were also implemented:

i. Acquired inputs and planted maize, legumes and fodder crop demonstrations under CA farming practices. Held eight planning meetings with the farmers who are also members of the local agricultural innovation platforms (LAIPs).

ii. Conducted six training meetings in the region on group dynamics, post-harvest handling of maize/legumes and production of fodder crops;

iii. Co-opted more members into joining the LAIPs. This is particularly in Mariani site where three more platforms were formed to address the project's issues in three more ranges (locations) in Tharaka/Nithi County. The program continued collaborating with the Anglican Christian Churches and Schools (agricultural development unit where promotion of the SIMLESA endorsed crop varieties such as pigeon peas and maize) and CA farming practices were taken by more than 600 farmers (566 females and 34 males). In particular, the majority of the farmers recorded on average 300% pigeon pea grain increase for crops harvested in August 2016.

In Tanzania, the 2015/2016 season saw SIMLESA, in collaboration with Karatu, Gairo and Kilosa district councils and RECODA, establishing demonstration plots for scaling out SIMLESA proven technologies. These were use of drought tolerant, high yielding maize varieties, high yielding disease resistant legume varieties, fertilizer and CA. In Karatu, 10 demonstration plots were established in two villages of Endabash and Mbulumbulu. In Gairo 16 plots were established in Tabuhotel and Ibuti villages while in Kilosa District nine plots were established in Peapea and Mhenda communities.

SIMLESA Competitive Grants Scheme (CGS)

Steps of the CGS

i). Planning and strategy development – this resulted in a scaling strategy.

ii). Call announcement – through internet and local daily newspapers.

Table 4.2 Number of SIMLESA CGS applications and selected partners

Country	Applicants considered	Selected partners	Sites
Kenya	28	4	National
Malawi	16	3	National
Mozambique	9	3	6 districts
Tanzania	14	3	6 districts
Total	**67**	**13**	

The 67 applicants are those that:
- did not contravene any application guidelines, including using the official application template
- submitted new proposals – not from previous calls that were unrelated to the SIMLESA CGS
- submitted proposals on time

iii). Proposals and partner selection

- Commissioning in Ethiopia – seven public extension zonal offices
- Competitive process in Kenya – four partners, Malawi – three, Mozambique – three and Tanzania – three partners.

Twenty partners have been identified. Each of them will further work with other organizations, especially seed companies, extension, private sector, farmer organizations, among others. The table 4.3 below shows names, types of the selected partners, and the partnerships being established in each country, and across SIMLESA. The selection at country level was informed by the need for complementarity in expertise so that the beneficiaries could have a full package.

Table 4.3 Selected partners in each country

Country	Farmer Ass.	ICT	NGO	Media	Seed	University	Church org.	Level
Kenya	Secondary partners esp. AIP	Secondary partners – QAAFI, Mediae		Mediae ltd.	Freshco Seed Co.	Egerton	NCCK	County
Malawi	NASFAM	Sec. partner – QAAFI, FRT		Farm Radio Trust (FRT)	MUSECO			National
Mozambique	UCAMA	ISPM, QAAFI	AgriMerc ODS	ISPM	Secondary partners	ISPM		National (weak)
Tanzania	MVIWATA	Secondary partner – QAAFI, CABI	RECODA	Secondary partner	SATEC	Secondary partner – Sokoine Uni.		National

Table 4.4 The first grant payment have been made to the CGS partners listed:

#	Country	CG Partners
1.	Mozambique	Organização Sustentável Para o Desenvolvimento Sustentável da Agricultura e Mercados Rurais (Agrimerc)
2.	Mozambique	União Provincial de Camponeses de Manica (UCAMA)
3.	Mozambique	Instituto Superior Politécnico de Manica (ISPM)
4.	Malawi	National Smallholder Farmers' Association of Malawi (NASFAM)
5.	Malawi	Farm Radio Trust (FRT)
6.	Tanzania	Suba Agro Trading & Engineering (SATEC)
7.	Tanzania	Research, Community and Organizational Development Associates (RECODA)
8.	Tanzania	Mtandao wa Vikundi vya Wakulima Tanzania (MWIWATA)
9.	Kenya	National Council Of Churches of Kenya (NCCK)
10.	Kenya	Mediae Company
11.	Kenya	Egerton University
12.	Kenya	Freshco Kenya Limited
13.	Ethiopia	Ethiopian Institute of Agricultural Research

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

Main stakeholders of SIMLESA, NARS and farmers were empowered in various forms from the inception of the program through short trainings, educational support, participating at international conferences, on the job training, farming equipment support, field days, exchange visits and hosting demonstration sites. During the reporting period, two MSc students submitted their final thesis, they are expected to graduate in early 2017. These two MSc candidates are from Mozambique and are enrolled at the University of Free State in South Africa. One Ethiopian PhD student who is in his second year is currently collecting research data.

QAAFI provided trainings on utilization and awareness of the SIMLESA SMS platform which has been completed in each of the countries for NARS and CGS partners. The course has links to eDX at UQ as a special private online course (SPOC) where by one gains access to their development workshops and some professional video production. The QAAFI site is now running WordPress 4.4 which should allow posts to be embedded in other blogs. QAAFI set up a YouTube channel and G+ page for the website to gain access to a wider audience, data management section, use of Metatags and Open Graph tags (though a plugin).

In Tanzania, a training workshop on SMS was conducted at Selian Agricultural Research Institute (SARI) on the 17th to 18th October, 2016. The workshop was organized by University of Queensland-Australia and CIMMYT in collaboration with Selian and Ilonga agricultural research institutes.

Workshop participants were the SIMLESA scaling partners RECODA, MVIWATA and SATEC and Researchers for SARI and Ilonga research stations. At the end of the workshop, partners developed SMS work plans which will be monitored continuously during the implementation phase of the project.

The objectives of the workshop were for partners and researchers:-

i) To learn how to use the SMS system to assist the scaling out of SIMLESA technologies.
ii) To learn how to develop SMS content to be sent to beneficiaries (farmers, extension, agro dealers etc).
iii) To develop SMS message content information work-flow from scaling partners to SARI and ARI-Ilonga for approval and sending to beneficiaries.
iv) Workshop participants were from Selian and Ilonga Agricultural Research Institute involved in SIMLESA program, Competitive Grant Scaling-out (CGS) partners, university of Queensland and CIMMYT.

In addition, SIMLESA-Tanzania scheduled for an in-country training which will be facilitated by ARC South Africa targeting young research scientists. Arrangements have been made and the training will be conducted in the second week of February 2017. This training will capacitate researchers, especially young scientists to be able to analyze the research information for public use and publishing in peer reviewed journals.

Gender data collection and data analysis training was done in all SIMLESA countries between August and October 2016. The training was conducted in preparation of two gender mainstreaming studies which were targeting value chains and AIPs. In Kenya, research assistants also included two MSc students. These two Kenyan Masters Students are pursuing degrees in Agricultural and Applied Economics at the University of Nairobi. The first is Jessica Osanya, whose thesis is titled “An Assessment of Gender Roles in Farm Decision-Making and their Effect on Maize Production Efficiency in Kenya.” Osanya is using Kenya households and Individual Adoption Pathways Responses, collected in 2013 to carry out her study. Osanya is expected to graduate in May, 2017. The second student is Dennis Olumeh, whose thesis is titled, “Determinants of Market Participation in Male and Female Maize

Farmers in Kenya." Olumeh is using Mozambique and Kenya household SIMLESA datasets collected in 2010/2011, to carry out his study. He is expected to graduate in August, 2017.

In Kenya two KALRO researchers (Bernard Rono and Alfred Micheni) participated in a Kenya Cereals Enhancement Program (KCEP) training during the last half of 2016 in Embu. KCEP is a collaborative program funded by the European Commission (EC) and being implemented by the International Fund for Agricultural Development (IFAD) and other stakeholders - including KALRO. The main objective of KCEP is to contribute to the reduction of rural poverty and food insecurity of smallholder farmers by increasing production of cereal staples and associated pulses in selected areas of Kenya.

Spillover Countries

SIMLESA spillover countries implemented their programs with varying degrees of success. The detailed progress updates are under Annex 1 section.

2 Impacts

2.1 Scientific impacts

Through partnership and collaborative research in the target countries, in line with the program design, the SIMLESA program has consistently maintained its focus on generating scientific impacts. This is also in line with the acknowledgement that the functionality and effectiveness of the program depends on the capacity of partners including those strategic players who can translate research results into meaningful deliverables on the ground, particularly *the desire to turn research into impact*. This resonates with the CIMMYT50 years (1966-2016) celebration theme.

The trials were designed to use evidence-based data that is collected using scientifically proven methods, analyzed, reported and published for wider use. The exploratory trials, although traditionally designed for simple demonstrations proved very easily understandable by small-scale farmers while at the same time providing data that have been statistically analyzed and producing very credible results which could be replicated for wider use to achieve more benefits. Partners' capacity has been strengthened through the collaborative research partnership with CIMMYT, QAAFI, CIAT and ILRI (particularly with the new focus on crop-livestock integration) enabling them to share research methods, tools and their applications.

During the period under review, the program has continued to keep track of adoption pathways as a way of monitoring the efficiency of its scaling out strategies and impact pathways as a vehicle for assessing viable options for transforming the lives of the smallholder farmers through the 2015/16 Adoption Monitoring Survey. The results are at analysis stage and preliminary ones across the five countries have been shared to inform the current sustainable intensification adoption rates. There are a number of success stories which have been documented during the period under review as evidence of SIMLESA impact on the communities through improved food and livelihood security.

In line with the program design, SIMLESA continued to embark on an extensive experimentation program to assess the longer-term benefits of conservation agriculture compared to conventional farming systems. It has been concluded that CA-based SI is the way to go to improve food security across SIMLESA sites, and beyond. It is against this background that the general recommendation was made to scale up and out conservation agriculture techniques as one of the strategic options for ensuring that SIMLESA is able to achieve its overall goal of increasing productivity in Eastern and Southern Africa by 30% from 2009 average by year 2023 and also reaching 650,000 farmers. The launch and roll on of the Competitive Grant Scheme during the reporting period is one of such deliberate efforts of reaching out to more farmers.

The latest compilation of SIMLESA's scientific contribution was reported by the Program Leader (ACIAR Seminar Canberra, 29-30 November 2016). SIMLESA's Science outputs include- 122 publications, 52 posters 15 policy briefs and various communication products including national level media coverages national, regional and international conference, participation by partners. An improved SIMLESA Website is serving as a source of materials and documents generated by the program.

3.2 Capacity impacts

During the period under review, SIMLESA continued to deliberately direct its efforts on trainings in conservation agriculture principles and technologies; sustainable and climate responsive agriculture production systems; agricultural production systems simulations; risk management and systems modelling acknowledging the socioeconomic dynamics of households in different sites.

The program continued to give priority to capacity building trainings at different levels of implementation, more specifically to both NARS and farmers at country level as well as through long-term graduate level studies. This is in line with the concept of sustainability which is embedded in the program design. SIMLESA program managed to strengthen the capacity of smallholder famers in good agricultural practices through an array of initiatives such as farmer- to - farmer exchange visits, specific trainings on improved agricultural practices, information exchange and participation in IP meetings.

The program prioritized capacity building of researchers and extension practitioners as shown by the number of people who got enrolled at different levels to improve their academic and professional qualifications so as to enhance implementation effectiveness and efficiency. This was also done with an ultimate aim to improve the capacity of young researchers in the areas of agricultural economics and plant science in an effort to build Eastern and Southern African national agriculture research and development capacity. A cumulative total of 65 students (42 students pursuing Master of Science degrees and 23 PhD students at national universities in SIMLESA partner countries) were being supported. Field days and exchange visits have continued to improve knowledge transfer which, as evidenced by stories of change has led to increase in yield of both maize and legumes thereby resulting in improved food security in SIMLESA operational sites.

Through the 59 innovations platforms across SIMLESA countries including spillover countries, links were formed with agro dealers facilitating improvement of market systems for farmers thereby boosting their incomes and widening market opportunity options. Efforts were being made for the innovation platforms to give more benefits to the program acknowledging that the IPs have great potential to address the issue of sustainability.

Linkages with the private sector and some seed companies across the SIMLESA countries continue to bring huge benefits in terms of expertise for NARS as implementers and program participants (farmers) in modern agronomic practices.

3.3 Community Impacts

SIMLESA aims to reach out in an efficient and effective manner, as many communities as the resources can allow so that there is more coverage as far as modern and scientifically proven farming technologies are concerned which at the end will improve food security at both regional and household level. During the design phase, the program set targets and adoption pathways to achieve this scaling out process in terms of the number of research communities covered, number of farmers reached out and the number of adopters (these being the farmers who have learned, embraced and started practising SI technologies)

During the period under review, the program managed to achieve cumulative of 235,422 farmers. It can be seen that SIMLESA has led to increased uptake of CA technologies both at community and household level though acknowledging that in some cases farmers were not taking the whole CA package. Participating farmers have given testimonies of better nutrition from legumes, improved soil fertility from residue utilization and reduced labour.

In Malawi, the national farmers' association, NASFAM, is using SIMLESA scaling-out approaches to reach out farmers beyond SIMLESA operational areas and spread out the community benefits. The SIMLESA MEL system has invested time to devise mechanisms of investigating and documenting this multiplier effect and report the actual figures brought about by this NGO innovation. The MEL focal person in Malawi had been tasked to gather information to comprehensively inform this initiative.

3.4 Economic impacts

SIMLESA has brought increased use of CA-based SI-/options technology in communities which have also led to evident reduction of production costs and increased crop productivity per unit area especially and dietary diversification in farm households where maize and legumes are intercropped. For example, the increase in maize and legume production in Tanzania and reduction in labor by 50 %. Maize and legume intercropping has also led to reduced risk in the event of moisture stress, provision of both carbohydrates and proteins to households as well as improved soil fertility in the long run through crop residue retention. The use of crop residues to improve soil fertility has led to the reduction in expensive fertilizer use. The program has also led to the breeding of area specific maize and legume seeds thereby leading to less drought risk and pests and reduced yields. If this momentum could be maintained, the program will enhance income, food and nutritional security through science and partnerships, as espoused by the overall SIMLESA goal.

3.5 Social impacts

SIMLESA, on the social dimension side, continues to improve family fabric through the hosting of exploratory trials which promote the participation of men, women and youths thereby making everyone strategic and important participant in household farming activities. This is in line with the program design requirements where gender mainstreaming is at the core.

The approach has also led to improved family cohesion giving women opportunities to contribute to household decision- making. The establishment of innovation platforms in the communities has created a sense of ownership of SIMLESA and assisted in demand driven research and development approach. Innovation platforms continue to be enablers for the sustainability of intensifications options beyond SIMLESA hence building their capacity remains crucial.

In terms of partnerships, SIMLESA Phase II has been well aligned and has benefited immensely from a number of past and current ACIAR-funded projects and initiatives.

3.6 Environmental impacts

The El Niño-induced drought did not spare Eastern and Southern African countries. More specifically, El Niño put 30 million people on the brink of starvation in Southern Africa over the few seasons. The outlook for smallholder farmers in Southern Africa in the cropping season was bleak. Erratic rainfall and record-breaking temperatures resulted in large-scale crop failures in most countries. This has coupled with lack of access to information and inputs, poor soils, unfavourable weather conditions, pests, disease and inadequate agricultural extension services became major factors limiting smallholder farmers in Eastern and Southern Africa, from increasing their maize productivity.

Climate change is expected to negatively impact agricultural production in SIMLESA countries. Low-nitrogen stress combined with drought and heat stress will become increasing constraints on maize production, and on growing improved varieties. Improved agricultural technologies, agronomic practices and climate-smart national policies are essential to offset projected yield declines. SIMLESA attempts to mitigate against this plethora of environmental factors.

SIMLESA places environmental concerns as key to its agricultural development interventions because sustainable farming practices are critical to long-term profitability.

Through its projects, SIMLESA continues to promote conservation agriculture and maize-legume intensification to respond to declining soil fertility and sustainably increase the productivity and profitability of current farming systems. Increasingly, SIMLESA adapts its products to more erratic rainfall, increased heat stress and seasonal dry spells in Eastern and Southern Africa. The cropping systems it promotes can be labelled as climate-resilient, according to IPCC(2014), SIMLESA uses different strategies to improve farming system productivity depending on the agroecology, the socioeconomic environment and farmers' resource endowment, and its interventions are based on good agricultural practices, minimum soil disturbance, residue retention and diversification through rotation with legumes and green manures.

3.7 Monitoring, Evaluation & Learning

The Monitoring, Evaluation and Learning (MEL) Unit continued to keep track of program performance across the SIMLESA countries updating indicators in the Indicator Tracking System as well as updating figures in database as a way of strengthening the internalized SIMLESA MEL system. There was significant time allocated to the reviewing of the Competitive Grants Scheme proposals ensuring that the MEL components of the proposals are clear in terms of targets and milestones and that there is adequate communication between the resources allocated and the activities to be carried out. This culminated in support trip visits to Malawi, Mozambique and Tanzania to make sure there is explicit understanding on what needs to be done, by whom, when, where and using what resources in the CGS proposals.

The MEL unit has strengthened its focus in line with the MTR recommendation on outcome and impact indicators acknowledging that SIMLESA II should be characterized by evidence of the effects which the program has on the smallholder farmers. The focus on outcome indicators is more appropriate now as the program is less than two years before closure. The unit has been urging countries to populate yield changes, labour savings, benefits associated with market linkages, among others, and see how these impact positively on the livelihoods of the farmers.

3.7.1 SIMLESA Achievements from an ME & L perspective

SIMLESA continued to perform a number of activities in CA-based sustainable intensification which the MEL desk has kept tracking overtime. Acknowledging that the program is less than two years before its conclusion, the MEL desk has now focused more to check the effects of these activities on the communities as previously articulated. The main MEL focus at this juncture is to answer the big programmatic question, "***How far has the program gone in sustainably increasing the productivity of selected maize based farming systems in each targets in Eastern and Southern Africa by 30% at the same time reduce seasonal down-side production risks by 30%?***" This should then assist the program to link with the SIMLESA aim of increasing food security and incomes at household and regional levels and foster economic development. The SIMLESA achievements among other benefits which are directly attributable to the program are articulated below:

In Ethiopia - Bako area (Western Ethiopia) maize CA at the time of reporting was on average 10.1 tons per hectare while hybrids soybean under CA was 2.4 tons per hectare. In southern region: Maize 5.24 tons per hectare and beans 2.72 tons per hectare while in Central Rift Valley maize yield on farm: 3.69 tons per hectare both hybrid and open pollinated; common beans was 2.08 tons per hectare.

Selection of best bet options through exploratory trials has led to increase in crop yield. For example, in Kenya maize grain yield increased from 0.4 tons per hectare in 2010 to about 4.0 tons per hectare at the end of 2015. At the same time, the sole bean yield increased from 0.2 tons per hectare in 2010 to over 2.0 tons per hectare. The yield increase was attributed to improved field management after being exposed to SIMLESA SI technologies.

In Tanzania, the results of exploratory trials showed an improvement of maize grain yield from 0.5 tons per hectare to about 2.5 to 4 tons per hectare and 1.5-3 tons per hectare legumes yields through drought-tolerant crops from practicing conservation agriculture to other farming practices. By adopting conservation agriculture, smallholder farmers benefited from reduced cost of production while saving on labor. Farmers have saved on time by 50% for other economic activities through adopting zero tillage.

In one of the spillover countries, Uganda, a combination of PPB and rip-line tillage together with improved seed and fertilizer brought maize yield within the expected country productivity range for maize range from 3.8 to 8.0 tons per hectare.

A total of 268 and 378 maize and legume on farm Participatory Variety Selection (PVS) were conducted where best performing maize and legume varieties that met famers' preferences were selected and scaled up by partner companies. The varieties were selected based on grain yield, maturity, drought-tolerance, pest resistance and palatability. The selected hybrids yielded 30-40% more under drought and 20-25% under optimum conditions compared to commercial checks. Drought has become very prevalent in Eastern and Southern Africa such that the coming in of selected drought - tolerant varieties came as a great relief to farmers.

Malawi, for example, has proved that the adoption of CA-based SI practices can enhance production risk management. The highest crop yield and reduction in downside risk as well as reduction in the cost of risk was achieved when farmers adopted crop diversification and minimum tillage jointly rather than individually. The reduction in probability of crop failure was higher (72%) with joint adoption of sustainable intensification practices than when they were adopted individually (30-42%). The results also indicated that the cost of risk is higher for non-adopters compared to adopters' counterparts.

1.8 Gender Integration

During the reporting period a number of gender related studies were carried out in SIMLESA countries. Studies conducted were:

Study 1: Agricultural Innovation Platforms and Gender Equity in Mozambique
Study 2: Agricultural Innovation Platforms and Gender Equity in Kenya
Study 3: Agricultural Innovation Platforms and Gender Equity in Tanzania
Study 4: Gender Analysis on Maize or Legume Value Chains, a Case Study of Kenya
Study 5: Gender Analysis on Maize or Legume Value Chains, a Case Study of Mozambique
Study 6: Characterizing Smallholder Maize Farmers' Production and Marketing in Kenya: An Insight into the Intra-household Gender, Wealth Status and Educational Dimensions.

Details of gender studies are contained in attached gender report

1.9 Communication and dissemination activities

To promote collaboration, lesson learning and networking with like-minded institutions regionally and internationally, the SIMLESA program:

- Participated at the Forum for Agricultural Research in Africa (FARA) in Rwanda
- Had interactions with other institutions at the African Green Revolution Forum (AGRF) meeting
- Participated at the International Agronomy Conference in India

The SIMLESA program also had linkages with new projects, proposals and initiatives (ACIAR supported). As climate change impacts the global ability to grow food, both in quality and quantity, researchers in agriculture have become an important asset for establishing long-term food security as the world's population continues to increase.

In December, SIMLESA program coordinator was part of agriculture and food security researchers who visited Canberra for high-level discussions on development matters with ACIAR and Department of Foreign Affairs and Trade. As 2017 will be an important year for establishing long-term goals and making important inroads into advances within the sector, SIMLESA and its partners developed a concept note on a potential follow-on project, SIDICSA.

During the reporting period the communications unit developed and produced communications and knowledge products as follows:

- SIMLESA Bulletin (September 2016)
- SIMLESA Overview flyer

One poster on sustainable intensification, nutrition and food security was produced for the international agronomy conference, as well as the Canberra meeting.

Extra efforts were effected to ensure that the SIMLESA website is continually updated to include the breadth of outputs and data coming from the program.

On articles, the communications department produced the following articles:

- Confronting Africa's soil health crisis helps triple yields: http://www.cimmyt.org/confronting-africas-soil-health-problems-helps-triple-yield/

- Growing more with less: Improving productivity, resilience and sustainability in Africa: http://www.cimmyt.org/growing-more-with-less-improving-productivity-resilience-and-sustainability-in-africa/

Local and national scaling out linkages with agribusiness, extension and other large agricultural development programs are being identified to foster information dissemination and adoption of technologies and seed systems through innovation platforms. In the five SIMLESA countries, local innovation platforms dealt with different thematic areas, such as crop-livestock integration, CA-based sustainable intensification technology, and are expected to continue up to the conclusion of program activities in 2018. These activities are aimed at promoting information dissemination on CA-based sustainable intensification technologies. For Malawi, the team is working with other donor funded projects, such as IFAD.

3 Training activities

During the period under review, program monitoring visits were conducted in all the SIMLESA countries by ME&L specialist and the management team. Monitoring and evaluations frameworks for CGS were developed during the reporting period. Other trainings conducted include farmer training on agronomic aspects, gender data collection and analysis training detailed under ME&L section.

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4 Intellectual property

Nothing reported on intellectual property during the period under review.

5 Variations to future activities

Activity variations were reported in previous progress report – no variations during the reporting period.

6 Variations to personnel

There were no personnel variations for all partners except for Ethiopia where 14 staff left and currently 11 were replaced during the reporting period as detailed in Table 7.1.

Table 7.1: Ethiopia personnel variations

Name	Agency/position	Role in the program	Variation	Objective
Abebe	ARARI	Agronomist	Team member July 2016	2
Yalfal Temesgen	ARARI	Socioeconomic-Representative Focal person	July 2016	1
Yeshitila Merene	ARARI	Entomology-Focal Person	Focal person	All objs
Beyene Abebe	ARARI	Maize breeder	Team member	2
Eshetu Derso (PhD)	EIAR	Crop Research Director	Joined – Oct 2016	All
Dereje Ayalneh	MARC-EIAR	Maize breeder – Obj3 Leader	Left Oct 2016	-
Muluken Philipos	WARC-EIAR	Centre Director	Team member	1
Goshime Muluneh	WARC-EIAR	Maize breeder	Focal person (left Sep 2016)	3
Mesele Haile	WARC-EIAR	Pathologist	Focal person (assigned Sep 2016)	3
Yohanis Seyoum	SoRPARI	Maize breeder	Focal Person Ict 2016	All objs
Abebaw Shimelis (PhD)	SoRPARI	Agri. Economics	Left Oct 2016	=

7 Problems and opportunities

In Southern Africa, particularly in Malawi and Mozambique, countries are currently receiving favourable rains compared to previous farming seasons. It is forecasted that 2016/17 is going to be a good season particularly for Malawi and Mozambique. CGS partners were contracted in all SIMLESA countries. Therefore, an increase of uptake of SIMLESA technologies are expected from now till end of the program.

In Malawi, most seed companies' staff involved in seed multiplication programs had little experience in seed production hence they required constant backstopping by the Department of Agricultural Research Services (DARS) as well as training in seed production processes. Lack of irrigation facilities for most seed companies limited their seed production.

Other challenges included:

- Late submission of progress reports by some NARS partners (Kenya) ,ILRI and CIAT created challenges for the project management Unit
- Political unrest and instability in the major SIMLESA Ethiopia sites created mobility restrictions and the current State of Emergency in the country. The CGS in Ethiopia could not be implemented for the current cropping season
- High NARS staff turnover, particularly in Ethiopia where 14 staff were replaced during the reporting period.
- Mozambique also faced political unrest in the central province where SIMLESA –Mozambi is located.

8 Budget

CIMMYT headquarters to provide financial progress report.

Annex 1: Spill over countries and partner reports

Rwanda

During the period under review, SIMLESA-Rwanda continued implementing activities in three sites in three agro ecological zones (AEZ) in three districts (Table 6.1). These AEZs have different characteristics in terms of soils and rainfall. Bugesera is located in the lowlands of Rwanda (1000-1400 m above the sea) and is characterized by good soil fertility level but constrained by relatively low and especially erratic rainfall (900mm/year). The Central Plateau which is located in the middle altitude lands of Rwanda (1400-1800) is characterized by less fertile soils but by good rainfall although also unpredictable (1200 mm/year). Cyuve is located in the highlands of Rwanda (2000 m) and is characterized by fertile soils (volcanic ash) and heavy and well distributed rains (>2000mm/year). Rainfall in the sites is bimodal allowing two crop growing seasons. The specific crop production limitations are drought, in Bugesera, declining soil fertility in the Central Plateau and Birunga. The declining soil fertility is due to over cultivation and its corollary high susceptibility to erosion.

Table 6.1 Location of SIMLESA sites in different AEZ and districts of Rwanda

Site	**AEZ**	**District**
Gashora	Bugesera	Bugesera
Runda	Central Plateau	Kamonyi
Cyuve	Birunga/Volcanic	Musanze

In all the three sites, the objective of the intervention was to continue to raise awareness of farmers on the benefit of CA-based SI in terms of soil fertility improvement and positive impact on crop yields.

The mirror approach consisting of comparing non-tilled and tilled plots under the same treatment side by side was adopted. The objective of the trial was to compare the three sites in terms of responses to CA, the effect of tillage and non-tillage practices within each site and the effect of different treatments tested. The main factors were tilled and non-tilled plots. The plant test were bean and maize. The following treatments were considered: *T1: Manure; T2: Manure + DAP; T3: Manure + DAP + DI-Agro*[‡]*.* In Runda and Gashora both beans and maize were grown while in Cyuve only maize was grown.

In Cyuve, the season was good and the maize did well in both non-tillage and tillage plots. The difference between soil fertility management inputs will be determined after harvesting at the end of January 2017. The acceptability of CA is high and the possibility of upscaling is feasible. In Runda, the demonstration survived two dry spells at the earlier and maturing stages. Both non-tillage and tillage practices were equally affected. However, the program has been able to harvest bean and data will be analyzed in the next quarter. Maize is not yet harvested but it is facing severe dry spells at maturity period. In Bugesera both maize and bean were affected by dry spells at earlier stage.

Despite the fact that 2016 was an El Nino year, Rwanda were able to salvage the maize crop yield in Cyuve where the rainfall was relatively good. In this region, no significant differences in crop performance was observed between CA versus conventional tillage. Farmers were enthusiastic to have crops without tillage. In Runda, the project managed to harvest bean. Here also, there was no significant difference between CA and conventional tillage. The same trend could be observed with maize. But in this site an effort on mulching practice will be necessary. In Bugesera, no yield could be expected because of drought. However, during a normal year, CA is normally accepted in the region.

6.2 Uganda

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

Activities to address Objective 1 were carried out through agricultural innovation platforms. Previously an AIP was launched in Kalongo sub county, Nakasongola District. During the reporting period, besides AIP monthly meetings facilitated by the NARO SIMLESA program staff, the following were undertaken:

- orientation and mentoring sessions were conducted for business modeling consultants
- workshop was conducted to assess the supply and demand for business and commercial services in Nakasongola District
- Business model analysis among purposively selected private sector key actors

6.2.2 Stakeholders involved in Uganda

- Five business model consultants (three from Uganda, including one female and two from outside Uganda) were engaged in a two-day orientation and mentoring sessions, where business model analysis checklists were developed.
- Three private sector service providers (mechanized service providers, agro-input dealers and traders) were purposively selected as critical for scaling CA activities and engaged in a workshop.
- Business model analysis was initiated in Nakasongola District to assess prospects for setting up businesses for scaling CA technologies using three business packages namely: agroinput supply, mechanization (oxen) service provision and trader/ agro processors. Five businesses each from the three business categories together with five clients of each business (75) were analyzed to develop 15 business case studies

6.2.3 Short to medium-term benefits of activities to the community

The business model analysis has helped to understand the business atmosphere in the district. The analysis revealed that private entrepreneurship has the potential to contribute significantly to the adoption and scaling of research technologies. However, uptake was seen to be limited by the capacity of the private sector at local level to expand its business. Adoption and scaling could be enhanced by the bundling of goods and services, accessing finance, offering information on markets and input sources, enhancing entrepreneurship skills, promoting collective action and providing effective support services within an environment that is conducive to the development of small rural enterprises. Public-private collaboration, at county and sub-county level was believed most likely to be augmented through establishing multi-stakeholder Innovation Platforms as mechanism for information sharing, providing local support services and linking to upstream value chain stakeholders amongst others.

6.2.4 To test and adapt productive, CA based intensification options for sustainable smallholder maize-legume production systems.

The main activity during the review period (July – December 2016) was the establishment of on-station and on-farm trials/ demonstrations.

In Uganda, there are two cropping seasons in a year. The first cropping season lasts between March and May with a rainfall peak in April, while the second season is between October and December with a rainfall peak in October/ November.

To establish the trials/ demonstrations, farmers were supplied with inputs including improved maize seed, herbicides and fertilizers. This was preceded with pre-season meetings in which farmers, researchers and staff from the districts' production departments together reviewed the goals, activities, and milestones of the previous season and discussed challenges and teased out approaches to overcome the challenges.

A total of 68 trials/ demonstrations were established, two of these were on-station (at the National Agricultural Research Laboratories (NARL) – Kawanda in central Uganda and Ngetta Zonal Agricultural Research and Development Institute (NgeZARDI) in northern Uganda). In addition 66 trials/ demos were established on-farm: 24 in Lira District, northern Uganda; 26 in Nakasongola District including one that was researcher managed, central Uganda and 16 in four districts in eastern Uganda as indicated in the table below.

Table 6.2 On-station and on-farm trials/ demos established in various institutions and locations

Districts	On-station	On-farm
Lira	-	24
Nakasongola	-	26
Eastern Uganda (Bugiri, Namutumba, Budaka, Busia)	-	16
NARL – Kawanda	1	-
NgeZARDI	1	-
Total	2	66

There are a total of 80 facilitated farmers and an unknown number of adopters in the groups supported by the program and outside the program. Facilitated farmers are provided with the required inputs to establish the trials/ demonstrations but the farmers themselves provide labor to maintain the trials/ demonstrations. Although the number of adopters is unknown, during the second season the program received requests from various farmers through their group leaders to procure for them improved maize seed and herbicides, using their own money. This was prompted by the good performance of the maize seed supplied by the program in the first season as compared to other maize seed which the farmers used to plant. A total of 500 kg was procured, which was used to plant 25 hectares.

Farmers using technologies such as rip lines and permanent planting basins (PPB), introduced by the SIMLESA program, in combination with improved seeds and fertilizers and/ or manure, have seen their bean grain yields increase from as low as 300 kg ha^{-1} to 1,000 kg ha^{-1}, although the yield potential of beans in Uganda is 2,000 kg ha^{-1}. Maize grain yield has increased from an average of 3,000 kg ha^{-1} to 6,000 kg ha^{-1}; yield potential for hybrid maize ranges from 5,000 to 8,000 ha^{-1}. Both PPB and rip-line tillage have significantly increased maize and bean grain yields on farmers' fields relative to conventional tillage methods. A combination of PPB and rip-line tillage together with improved seed and fertilizer brought maize and bean grain yields within the expected productivity range for both crops in Uganda.

Although the project started operating with a number of already existing farmer groups, these were weak and resource constrained. However, with program support, the groups have been strengthened and are now more coherent, and group and personal resources have also been enhanced. This has been achieved through constant engagement, hands-on training and exposure to technologies and tools and implements along the commodity value chain. For example, some groups and individuals have started buying agricultural inputs such as fertilizers, improved seeds, and herbicides using their own resources. Other inputs procured are spray pumps, oxen and ox-rippers, and some have gone on to construct storage cribs.

Other benefits which have been highlighted by the farmers include reduced production costs and time; the use of herbicides for preparing the land, and rippers and direct seeders, which the farmers are now using have made this possible. Farmers have also realized increased crop yields in seasons with normal rainfall, while in seasons with below normal rainfall they still realize reasonable yields compared to their colleagues who are not practicing. Furthermore, farmers have benefitted from proper post harvest handling: storage cribs have helped farmers to realize proper storage and they can now afford to keep their produce and sell only when there is high demand, thus fetching premium prices for their produce, which was not the case before.

Lead farmers have been trained in conservation agriculture and other sustainable land management practices; these have continued training other farmers in their areas.

A Technical Service Unit was created, trained and equipped with CA implements such as pedestal sprayers, oxen rippers, and direct seeders to offer technical services in each sub county to upscale the CA operations.

6.2.5 To increase the range of maize, legume and fodder/forage varieties available to smallholders.

During the review period the SIMLESA program continued with maintenance of the elite pigeon pea seed multiplication plots both at NARL – Kawanda and NgeZARDI. Five pigeon pea elite lines [ICEAP 00850, ICEAP 00540, ICEAP 00557, KAT 60/8, and ICEAP 00554] were acquired from ICRISAT and planted at NARL – Kawanda and NgeZARDI. These are being evaluated for performance and the seed multiplied for up scaling. Pigeon peas, especially the elite lines, are high biomass- and grain-yielding. In that regard, they are multipurpose because they can be used as a source of high quality grain food and as cover crops.

Farmers have been introduced to improved maize bean varieties, which are drought tolerant and high yielding. The maize varieties include 10H and PH5052 while the bean varieties include NABE 14 and 15.

Table 6.3 The following table shows the number of farmers, by gender, benefitting from improved maize and bean seed.

District	Gender		
	Male	**Female**	**Total**
Lira	12	12	24
Nakasongola	14	12	26
Eastern Uganda (Bugiri, Namutumba, Budaka, and Busia)	11	5	16

Two seed companies were engaged to supply the improved maize varieties, that is, Pearl Seeds which supplied PH5055 and Masindi Seeds.

Farmers have been introduced to drought tolerant and high yielding maize and bean varieties which address some of the core objectives of the SIMLESA program, that is, to reduce downside production risks by 30% with the ultimate goal of improving food security among smallholder farmers.

6.2.6 To support the development of local and regional innovation systems and scaling-out modalities.

For scaling out, preseason meetings were held, one each in Nakasongola and Lira district. During such meetings farmers are given hands-on training and receive a training of trainers course so that they could train other farmers in their areas.

During the review period, the program worked with one agricultural innovation platform, which was established in Kalongo sub county, Nakasongola District. The AIP is comprised of 100 stakeholders, including NGOs, financial institutions, researchers, local leadership, agro inputs dealers, oxen mechanization service providers, traders and agro-processors. The platform focuses on the maize–bean commodity value chain. Early land preparation, improved seed varieties and post-harvest handling techniques were identified as the three entry points. For sustainability purposes, an AIP steering committee of nine members was formed and a constitution for the AIP developed.

6.2.7 Capacity building to increase the efficiency of agricultural research today and in the future modalities.

Farmers were trained in herbicide use and calibration of sprayers. Different types of weeds, pests and diseases for both maize and beans were taught; Farmers were taught the right control and preventive measure, advised on the right pesticides that can be applied. Farmers were taught how to calibrate the sprayer to maintain the right measurement of the herbicide to be sprayed. Emphasis was also on conservation agriculture principles.

6.3 Botswana

The 2016/17 Botswana SIMLESA II activities were focused in Gaborone (Sebele) and Leshibitse (Kgatleng) districts. In Sebele, long-term CA research plots will be implemented in the 2016/2017 agricultural season. A number of stakeholders are involved in SIMLESA; Dikgame-Tse-Ntle Cluster Farmer's Committee and its 29 members, DAR headquarters, Kgatleng District Office, ASSP, Agri-Fountain and the extension staff. The stakeholders met in September to map out implementation arrangements. At the meeting, the stakeholders unanimously agreed that it was vital for them to collaborate since they are all targeting one client - the farmer. Agri-Fountain informed other stakeholders that it has adopted Dikgame-Tse-Ntle Cluster. Four farmers will continue to participate in the program and they are members of Dikgame-se-Ntle Cluster which covers around 600 hectares. One farmer whom all the treatments (tillage and cropping systems) were successfully implemented during 2015/16 has dropped out of the race and replaced by another farmer from the same cluster. Further, there are doubts that the farmer who is located outside the cluster is unlikely to participate in the program according to the cluster's secretary. The conservation agriculture - related practices promoted through the demonstrations at the sites are rainwater harvesting, minimum tillage and cropping systems. Unlike during 2015/16 cropping season, the current season is promising since the meteorological services department has predicted normal to above normal rains.

The Department of Agricultural Research, in partnership with the Department of Crop Production, undertook a farm walk in the Kgatleng District to demonstrate to farmers some principles and benefits of CA during the reporting period.

Due to the dry weather conditions coupled with intense heat wave which have been prevailing in the southern part of the country in December 2017 planting has been delayed at both Leshibitse and Sebele and will be implemented during January 2017 as the country received effective rains during the reporting period..

6.4 ASARECA

The main activity in the latter part of 2016 was following up of actions agreed in the 2015 joint communiqué of the Ministers of Agriculture of SIMLESA participating countries. By the end of 2016, follow-up visits had been made in Kenya and Mozambique and initiated in Malawi.

(a) Kenya

Dr. Michael Waithaka met with Dr. Johnson Irungu, the Director of Agriculture, Crop Resources, Agribusiness and Market Development Directorate in the Ministry of Agriculture, Livestock and Fisheries on 11th August 2016. The meeting constituted a briefing of the key actions being undertaken by the Ministry aligned to the joint communiqué.

These included: the establishment of community-based storage and drying facilities for grains; improvement in efficiency in cereal marketing and trade; promoting formation of marketing groups and associations; up-scaling of surveillance and control of pests and diseases; and strengthening of public-private partnerships in development and maintenance of market infrastructure. Several government initiatives had increased access to credit for agriculture from KES 3.3 Billion in 2013 to 3.5 Billion in 2014 and farmers accessing credit had doubled from the initial 38,000 in 2013.

With regard to enhancing access to inputs, the National Accelerated Agricultural Inputs Access Program is offering targeted subsidy to resource-poor farmers for them to increase yields and production to meet household food security and generate surpluses for sale. It focuses on availing fertilizer and seeds to 2.5 million smallholder farmers with one hectare or less of land at affordable prices. The fertilizer subsidy program started in 2008 to enhance access to fertilizer, had so far spent over KES 25 billion. In addition, the government had initiated the process of local fertilizer blending, and manufacturing through public private partnership arrangements. The production of certified seed for the drought tolerant crops is also being enhanced through the Traditional High Value Crop Programme. This program is a climate smart initiative with the overall aim of increasing crops production, particularly cereals and legumes in the arid and semi-arid areas.

With regard to the fifth area of the joint communiqué - Maize Lethal Necrosis disease it was noted that the disease continued to be a big challenge and a threat to maize production since first detected in 2011. It is being managed through several efforts:

- Germplasm Screening is being undertaken: over 8,000 maize accessions have been screened under natural and artificial disease inoculation at Naivasha. One variety WEMA 1101 tolerant for MLND has been released and three others are undergoing National Performance trials for release

- CIMMYT and KALRO have established the Maize Lethal Necrosis (MLN) Screening Facility at KALRO-Naivasha and Kiboko. The Kiboko facility uses double haploid technology which shortens breeding of resistance varieties from eight to two years.

- The government has released 25 new varieties of hybrid maize; seven varieties for low altitude/drylands; 16 for medium altitudes; 2 for high altitudes.

- The government is enhancing surveillance to monitor the spread of the disease for effective actions as well as supporting studies on the disease, particularly its spread to enable development of effective modes of prevention.

- The Ministry of Agriculture is also intensifying seed testing for both local and imported seed to curb the spread and transmission of disease through seeds.

- The ministry is also engaged in awareness creation among farmers and all stakeholders for purposes of timely detection and appropriate prevention, control and management.

This meeting was however, held on the backdrop of preparations for the annual summit during which the Ministry presents its performance report to the Head of State and the Nation on Monday 15th August 2016 and couldn't be exhaustive. A follow-up meeting was planned for September 2016 [although this is yet to happen] to assess priority gaps as outlined in the joint communiqué for mainstreaming in the plans of the Ministry and to identify areas for further collaboration and enhanced synergy.

(b) Mozambique

The follow up visit in Mozambique was made on 19th October 2016 by Dr. Michael Waithaka of ASARECA and Mr. George Mburathi, ACIAR advisor, based in Nairobi. The duo met staff of the Instituto de Investigação Agrária de Moçambique (IIAM) in Maputo including Dr. Olga Lurdes Faftine, the Director General, Agricultural Research Institute of Mozambique (IIAM); Dr. Anabela Zacarias, the Director, Crops and Natural Resources; Dr. Zacarias Massango the Director, Animal Sciences; Ms. Suzie Aline; Mr. Fabien representing the Director, Platform for Management of Centres of Research, Documentation and Technology Transfer, and Ms. Rogéria da Conceição Muianga, the Director, Planning, Administration and Finance.

Dr. Faftine was appointed head of IIAM in October 2015 and had consequently been unable to attend the SIMLESA policy forum. However; she was briefed specifically on the communiqué by the Mozambique delegation which comprised Mr. Feliciano Mazuze who represented the Ministry of Agriculture and Food Security in Mozambique and Domingos Dias the SIMLESA National Coordinator and staff of IIAM. Following this briefing, Dr. Faftine briefed the Policy Board of the Ministry in her capacity as a member. The Board had noted that most of the actions in the communiqué were already aligned with on-going initiatives in the ministry. Priority actions were however, identified to ensure sustainability of maize legume intensification after conclusion of SIMLESA program. These include:

- Disseminating information on SIMLESA technologies and innovations through the SMS- based extension system
- Incorporating the actions points in the joint communiqué in the ministerial policy pronouncement of the October 2016 season
- Attracting private sector players to support the SIMLESA communiqué actions
- Adding innovations and crop mixes that would help scale the initiative widely in the country.
- Inclusion of aspects of the joint communiqué that IIAM would like fast tracked in the speech of the national address by His Excellency the President of Mozambique when he opens the agriculture season on 28th October 2016. *Extracts of the Speech were shared by the Director General.*

(c) Malawi

An appointment to meet the Permanent Secretary, Ministry of Agriculture and Food Security in Malawi to assess progress in implementing the joint communiqué and identify areas for further collaboration was also sought. However, the year closed before a definite date had been communicated. More follow up will be undertaken for Malawi and the other countries in 2017.

1. **Documentation of evidence on conservation agriculture: convene a write shop with key technical people to collate and synthesize prevailing evidence on conservation agriculture in Eastern and Southern Africa**

A writeshop was not convened as had been planned. However, a proposal for an ACIAR Monograph series was mooted with the initial output expected to be a SIMLESA Book. The book will focus on the bigger picture to provide lessons learned and experiences gained on how to massively increase adoption and achieve yield increases and risk reduction targets ASARECA's contributing article which is still being drafted will be titled; "*Reaching hundreds of thousands: enabling policy environment for sustainable intensification*"

2. **Participation in SIMLESA meetings**

Dr. Waithaka represented ASARECA in the SIMLESA events including the SIMLESA side event held under the auspices of the 5th AGRF, UN Complex, Nairobi on 5th September 2016.

6.5 ILRI

Much of ILRI activities which were carried out during the reporting period were carried out in Ethiopia and Tanzania.

6.5.1 Ethiopia

Following the partners' workshop which was held on 23 May 2016 at the ILRI campus to harmonize the feeds and forage related activities among the research centers, a joint action plan and collaborative research agreements were signed between ILRI and each of the national partners; including Amhara Region Agricultural Research Institute (ARARI), Ethiopian Institute of Agricultural Research (EIAR), and Oromia Agricultural Research Institute (OARI). The work covered under this agreement aims to scale feeds and forage technologies at SIMLESA sites in Amahara, SNNPR, and Oromia regional states. To supplement the jointly planned activities, focus group discussions (FGDs) were conducted with representative farmers from each of the intervention kebeles (villages) so that farmers' views could be appreciated and their interests addressed with regard to the scaling of forage technologies to fill feed supply gaps. Most of the farmers' groups prioritized feed shortage as their main problem with livestock production.

Accordingly, 80 farmers in Amhara (Lalibela and Abchickly kebeles in South Achefer district) planted cowpea, lablab and sweet lupin forages intercropped with maize and as pure stand (lupin), 102 farmers in Oromia (Gambella-Tare kebele in Gobosayu district and Seden-Illu kebele in Illu-Gelan district) planted Rhodes grass, labalab, desho grass, pigeon pea and brachiaria grass and 106 farmers in SNNPR (Makbara and Gallo Argessa kebeles in Hawassa Zuria district, Chafa - 1 and Chafa - 2 kebeles in East Badawacho district, and Semen Dida, Ocha Geneme, Dobena Bati and Bati futo kebeles in Meskan district) planted Oats and Vetch mixture, brachiaria, desmodium and cowpea for feeding to their livestock and producing forage seeds as part of the plan to establish community-based forage seed supply system in the project sites.

Farmers in Meskan district (SNNPR) requested development assistance to grow irrigated forages using supplemental irrigation water from shallow wells delivered by motor pumps which they use to grow vegetables like onions and tomatoes for market. These farmers are interested in diversifying their income options by fattening small ruminants through feeding improved forages as a supplement to their local feed resources. To this effect, farmers were provided with seeds of oats, vetch and alfalfa to plant during the current irrigation season. On-farm demonstrations of planting have been made to farmers and the local research/extension staff. The farmers are in the process of land preparation to plant the forages. Technical assistance during the time of planting and training to farmers about the field management and utilization of the feed will be provided. Linking farmers to the local credit system and product market are some of the activities planned for the future.

In addition to the planting of forages for seed production on small-scale individual farms and farmers' training centers (FTCs), the partner research centers took the initiative of multiplying planting materials of Napier grass at their respective research farms to make it ready for next season's scaling to the wider communities.

Practical training and experience sharing events regarding forage establishment, management and utilization was provided by the partner research centers to the farmers and development agents in their respective kebeles. Fact sheets of some forages have been shared by ILRI to assist the trainings.

Farmers' field days to create more awareness within the wider communities about improved forages and their management to assist further scaling has been conducted by each of the partner research centers.

Prototypes of improved feeding troughs and feed conservation sheds have been shared by ILRI with each of the centers to demonstrate to the project farmers and create an experience sharing forums for the wider communities.

ILRI, with the help of its digital documentation officer has produced a digital story of the forage scaling process and the views of the farmers. This output will be published soon.

In collaboration with the team from QAAFI, ILRI has been supporting the use of modelling approaches to elaborate the outcomes and trade-offs of different feed allocation and livestock management strategies. The ILRI data on feed resource availability and utilization (from the FEAST studies previously reported) and data that we have collected on livestock productivity and market conditions have been used to parameterize the APSFARM model. Initial model runs have shown that the model is sensitive to changes in a range of scenarios for different agro-ecological zones and can be used to compare the relative energy efficiencies for various combinations of crop and livestock activities. These results are detailed by QAAFI elsewhere in this report. The QAAFI and ILRI teams are now exploring the development of further scenarios that might be used as a basis for recommendations on optimum resource use for SIMLESA's target farm households.

6.5.2 Tanzania

Tanzania completed baseline survey for 100 smallholder dairy farming households in each of Mbulu and Karatu districts of Manyara Region, Tanzania. These were drawn from three villages in each district. Karatu District (Ayala Bay, Lotia and Karatu villages), while in Mbulu District (Hydom, Dongobesh and Tumati villages) Importantly to note is that the villages and households for structured interviews were selected using multi-stage random sampling design based on the agro-ecological zone (highlands, midlands and lowlands) and dairy keeping presence upon an agreed transect in each village.

From the baseline sample of 100 farmers in each district, we have selected 30 farmers in each district (representing 10 farmers for each agro-ecology per village for the observational/intervention study to scale out suitable and improved 'best bet' forage from the Africa RISING project; enhance forage supply of seed and planting materials; enhance processing and utilization of crop residues and build capacity around feed technologies.

Two focus group discussions (FGD) were conducted in parallel with the household interviews guided by a checklist of questions. We employed participatory research approach, following the guidelines presented by FAO/WAAP (2008) - Scoring, ranking, seasonal calendar analysis, seasonal trend analysis techniques to capture information on seasonality effects on feed resource, water, milk production in three different AEZs (highlands, midlands and lowlands) throughout the wet, normal and dry seasons.

QAAFI progress report
December 2016

D Rodriguez, P deVoil, J Eyre, C Roxburgh, J McLean, M Mortlock

Progress on QAAFI's Log-Frame

Progress on QAAFI's Log-frame is reported below. Links to downloadable documents have been included in the document.

Progress on QAAFI's PhD students

Nascimento Nathumbo (Mozambique): has been awarded his PhD at The University of Queensland in January 2017.

Solomon Jemal (Ethiopia): Solomon passed satisfactorily his mid term thesis review. His next milestone is thesis review.

Caspar Roxburgh (Australia): Caspar has submitted his thesis to external reviewers and is awaiting feedback. Caspar has also submitted a second article for publication and is working on a third article. Caspar has also joined the QAAFI team to serve as assistant editor of SIMLESA's book.

QAAFI's Summary Report: December 2016

Objective 1: To enhance the understanding of CA-based intensification options for maize-legume production systems, value chains and impact pathways.

No.	Outputs / Activities	Milestones	Work plan 2017	Progress
Output 1.1	**Understanding CA-based intensification and feed options in selected farming systems**			
Activity 1.2.3	Participatory exploration of opportunities for investment in maize, legume and forage value chains through a better understanding of climate and market risks i) Two participatory modeling workshops per SIMLESA at one site per year identifying opportunities for the on farm demonstration of profitable and risk neutral CA-based intensification opportunities, ii) Risk analysis and investment options discussed at farmer group, and public-private partnership meetings.	Pre-season participatory modeling workshops with farmers, agribusinesses, extension and researchers across all SIMLESA countries and agro-ecologies to evaluate: • Expected seasonal conditions and necessary adjustments to best fit practice change • Analysis of risks and benefits from alternative practices, technologies and investment options • Changes in farmers' risk perception and farm investment	Develop manuscript on farmer interviews in Mozambique (2014) and ex-ante modelling	**Reporting to December 2016** • Results of the case studies were resented back to the farmers and the farmers contact details were given to the CGS partners for inclusion into the CGS activities. . Final report available HERE Copy this link in your browser https://www.dropbox.com/s/m42nyi899zsvv4r/Typology case study final.docx?dl=0 • Farmer interviews in Mozambique (2014) identified simple changes in agronomy (sowing date, plant densities, earlier weeding) that allow intensification of maize production based on farmer knowledge of local best practice. Interventions analyzed for seasonal risk with APSIM. A journal article is being prepared for publication by Caspar Roxburgh.
Output 1.3	**Functional farm-household typologies matched to CA-based intensification options**			
Activity 1.3.1	Adjusting structural typology of SIMLESA-1 to a functional typology based on adoption constraints of CA-based intensification options for different farm household types , building on additional survey data and interviews with identified representative case study households (i.e. output from SIMLESA-1),	A typology of farm households developed and validated Matched CA-based intensification options with identified farm typologies for potential out-scaling	See 1.2.3	See 1.2.3 The APSFarm-LivSim model was parameterized to simulate different qualities of feedstock in collaboration with ILRI. The model showed sensitivity to changes in feedstock quality and quality. Initial results can be downloaded from: https://cloudstor.aarnet.edu.au/plus/index.php/s/ziAuBHjo5p9SE03 At the moment we are waiting feedback from ILRI to define simulation scenarios for livestock intensification. We hope to report on this by July 2017.
Activity 1.3.2	Quantify the benefits and trade-offs of alternative CA-based intensification options for different	Report on benefits and trade-offs of alternative CA-based	Analysis of benefits and trade-offs from alternative	A journal article has been submitted for publication to Agricultural Systems. It was reviewed and requires Moderate Revision. The submitted article can be downloaded from the link below. D Rodriguez, P deVoil, M C Rufino, M Odendo, MT van Wijk To mulch or to munch? Big modelling of big data.

No.	Outputs / Activities	Milestones	Work plan 2017	Progress
	farm household types	intensification options for different farm household types	interventions will be developed using the APSFarm-LivSim model and the results from activities 1.2.1 and 1.3.1 Same analysis will be run for Ethiopia and the rest of the countries during the course of the project.	Manuscript: https://cloudstor.aarnet.edu.au/plus/index.php/s/bqwAdixD8VLIkCP Figures: https://cloudstor.aarnet.edu.au/plus/index.php/s/PCT77riy44Qh7yF Tables: https://cloudstor.aarnet.edu.au/plus/index.php/s/N8GBJYBmzta1pnj

Objective 2: To test and adapt productive, CA-based intensification options for sustainable smallholder maize-legume production systems

No.	Outputs / Activities	Milestones	Work plan 2017	Progress
Output 2.2	**Understanding productivity and soil health dynamics of CA based intensification practices**			
2.2.5	Testing the value of existing seasonal climate forecasting tools for Sub Saharan Africa	A report on the value of existing seasonal climate forecasting tools and native knowledge available across all five SIMLESA countries, and identification of how this information could be used to inform practice change across SIMLESA activities.	Develop one manuscript relating Ex-ante modelling to historical climate forecasts. Develop simple interpretations of SIMLESA soil characterization and the influence of crop intensification options	**Reporting to Dec 2016** • Ex-ante modelling the effects of residue retention and minimal soil disturbance at sites across southern Africa reveals that i) CA reduces the likely hood of crop failure and increases yields in driest 20 to 40% of years for shallow sandy soils (<110cm deep), ii) reducing population density increases yields in driest yields for all sites for current germplasm, ii) low population densities cause yield penalties in high yielding environments without prolific germplasm.
Activity 2.2.6	Developing site specific crop nutrient management tools under conservation practices	Development, calibration and validation of simple site-specific crop nutrient management tools for farmers and extension officers e.g. leaf colour charts for maize (as developed by IPNI for rice - Witt et al., 2005), in collaboration with farmers	Submit SOC manuscript for peer review. Develop a second manuscript on the effect of nitrogen fertilizer on yield and risk across target environments under CA. Summarize nitrogen management	**Reporting to Dec 2016** • One manuscript drafted on the effect of residue retention and mineral nitrogen inputs on SOC components in long-term CA trials. Abstract HERE • Spectral soil analysis of all SIMLESA long-term trial sites completed and further samples sent for wet chemistry to complete validation. • SIMLESA maize germplasm characterized for agronomy systems analysis of long-term trials. • Weed suppressing legumes relay cropped into maize reduced weed numbers and biomass by up to 50%. The effect of weed suppression on the following crop is currently being assayed.

No.	Outputs / Activities	Milestones	Work plan 2017	Progress
		Objective 2 and 3	tools for scaling	
Activity 2.2.7	Developing more sustainable and profitable intensification options in summer rainfall dominated environments of Queensland: Alternative sources of nitrogen inputs	A participatory study on the opportunities to reduce Queensland farmers' dependence on the use of nitrogen fertilisers. A communication program in collaboration with Conservation Farmers Inc. (www.cfi.org.au) reaching more than 300 farmers from Northern New South Wales and Queensland.		**Activity completed July 2016**
Activity 2.2.8	Developing more sustainable and profitable intensification options in summer rainfall dominated environments of Queensland: Reducing yield gaps in the grains industry	Results from replicated on-research station and on-farm trials reaching 300 farmers from Northern New South Wales and Queensland At least four field days and workshops in the Darling Downs and Central Queensland in collaboration with the Grower Solutions Teams from CQ, and CFI in the Darling Downs.	Publish one manuscript on maize and sorghum agronomy for north eastern Australia. Demonstrate intensification options to farmers. Develop project to test maize ideotypes (CIMMYT germplasm) with commercial partners	**Reporting to December 2016** • Parental lines of High yielding single stem prolific hybrids were imported from CIMMYT with the view to demonstrate the benefits of targeted maize ideotype on GxExM combinations on maize yield and resilience across north eastern Australia. Commercial partners where engaged to co-develop and test the new germplasm. • Sorghum and maize systems agronomy research highlights published in a field book that was disseminated to farmers, agri-business and researchers. Available HERE. Or copy this link into your browser: https://cloudstor.aarnet.edu.au/plus/index.php/s/2Ko1zL2Ema4PqS5 • A field day with farmers and sponsored by the private sector was organized for January 2017. Download flyer following the link below: https://cloudstor.aarnet.edu.au/plus/index.php/s/24AfpbQSndieExU • A study of yield diversity among sorghum farmers in Queensland led to the identification of drivers for high yield (earlier sowing date and adequate N fertilizer); Neither of these interventions had major downside risk based on subsequent APSIM analysis • Lack of clarity on best sowing times was identified among research and extension community; insufficient N fertilizer use was linked to higher debt per hectare of farm businesses • Three workshops in Darling Downs (Oct 2016) presented findings to growers • ABC Rural radio interview outlined findings, broadcast across rural Australia (Oct 2016) • Paper outlining this work has been submitted to International Journal for Agricultural Sustainability and is currently under review. • Conference paper discussing implications for extension services to be submitted to Australian Agronomy Conference 2017

Objective 4: To support the development of local and regional innovations systems and scaling-out modalities

No.	Outputs / Activities	Milestones	Work plan 2017	Progress
Output 4.3	**Knowledge sharing of relevant program innovations**			
Activity 4.3.1	Develop SMS-based	SMS services	Support Mozambique	**Reporting to June 2016** • New SIMLESA SMS User Manual published online. HERE

No.	Outputs / Activities	Milestones	Work plan 2017	Progress
	tools for site-specific decision support to deliver: (1) simple heuristics for crop management and other information at key times during the year to registered mobile users (service includes information from global seasonal climate forecasts, and in-crop nitrogen management tools). (2) technical, social networking (e.g. information on field days, trials, farmer to farmer exchanges (m/f), etc.), and market information to farmers, extension officers and other participants in the maize-legume value chain.	established in at least three SIMLESA countries	and western Kenya with continues use of SMS	Or copy this link in your browser: http://simlesasms.info/resources/SIMLESA_SMS_USER_MANUAL.pdf • CGS partners trained on integrating SIMLESA knowledge into existing agronomic recommendations and functional typologies for SMS. • Local committees formed in each SIMLESA country to manage SMS service locally in collaboration with CGS partners • Article highlighting SMS related advances published in SIMLESA bulletin. Download article HERE Or copy this link in your browser: https://www.dropbox.com/s/aemwfewtlh4yd17/SIMLESA SMS Bulletin Story v2.docx?dl=0 • The proposed methodology for development of a simple functional typology was presented to the CGS partners in Malawi and Mozambique. HERE Or copy this link in your browser https://www.dropbox.com/s/hz6araz40q9r4dv/CGS implimentation.pptx?dl=0

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

No	Outputs / Activities	Milestones	Work plan 2017	Progress
Output 5.1	**Training on technology targeting, value chain and system analysis provided to build and enhance capacity of national and regional programs (integrating gender where relevant)**			
Activity 5.1.1	Technical training on: (1) farm and household	Socio-economic, agronomic research skills of program partners in		**Reporting to June 2016** • Training provided on utilization and awareness of the SIMLESA SMS

No	Outputs / Activities	Milestones	Work plan 2017	Progress
	typologies and system analysis; (2) recommendation domains (including GIS skills); (3) CA-based Intensification in smallholder agriculture; (4) fodder/forage management in CA-based intensification; (5) soil quality in CA-based intensification; (6) interdisciplinary farming systems analysis; (7) value chain analysis; and (8) emerging topics. Supported by on site/on the job training.	the national and regional programs enhanced - Systems agronomy research skills of program partners in the national and regional programs enhanced. - Interdisciplinary research		platform has been completed in each of the countries for NARS and CGS partners.
Activity 5.1.2	Free on-line training courses on: 1. Experimental design, basic statistics and use of R (free statistics software) 2. Soil and weather monitoring	1. Experimental design and basic statistics using R free course available on line 2. Soil and weather monitoring free course available on line	Continue to develop further modules in the Online site. Under development are regression, working with count data and plotting data. Solving technical challenges in the online environment, while keeping the site simple so as to be available worldwide. Monitor the use and respond to feedback. Investigate methods/technology to allow online consultations with field staff.	**Previous reporting to June 2015** • The course has linked to eDX at UQ as a special private online course (SPOC) where by we gain access to their development workshops and some professional video production. • Potential to be a MOOC in 2016 once the modules are completed. **Reporting to December 2015** • Our site is now running Wordpress 4.4 which should allow posts to be embedded in other blogs. • We have increased security (since the hacking) with two layers of protection for the files • Set up a Youtube channel and G+ page for the website to gain access to a wider audience. • Improve our search rating through the use of Metatags and Open Graph tags (though a plugin). • Content developing a data management section, (requested) and advanced topics sections. • Part of the site may develop as a MOOC through eDX in 2016 • A detailed report on this deliverable can be downloaded from HERE Or copy this link in your browser: https://www.dropbox.com/s/ed2etjlzaiw4vr4/ProgRepMainDec2015..pdf?dl=0 **Reporting to June 2016** • This activity has been delivered, there is no new reporting to add
Output 5.5	**Training on extension capacity**			
Activity5.5.1	Extension capacity building based on country-specific training needs and short	Identified training needs, and provided relevant training	Development and editing of partner contributions to the SIMLESA booklet for the ACIAR monograph series. Copy this link into your browser to view the contents	**Reporting to December 2016** • No specific requests for training have been received.

No	**Outputs / Activities**	**Milestones**	**Work plan 2017**	**Progress**
	courses		https://www.dropbox.com/s/znslog5yphpw2bt/Proposal%20for%20an%20ACIAR%20Monograph%20Series.docx?dl=0	

Annex 3: SIMLESA Gender Activities

Summary of the SIMLESA Gender Research Activities from July 2016 to December 2016

Study 1: Agricultural Innovation Platforms and Gender Equity in Mozambique

The study was carried out from August to October of 2016, the study sought to do the following: (i) investigate mechanisms of equitable generation and sharing of benefits among men and women members; and (ii) to document underlying success factors that are critical for the positive outcomes of Innovation platform. The study was done in three Agricultural Innovation Platforms (AIPs) in Mozambique. The study documents broad benefits of the AIPs, including crops, business, and environmental, social and infrastructural related benefits. We used the Participatory Audit Tool (P-Audit) is a holistic technique for assessing AIP scientifically. We triangulated data through case research. P-Audit is structured, designed to be administered including by non-social scientists to generate both numeric and qualitative data. P-Audit is based on the Likert's summative scaling method. However, rating of benefits (items) is done by knowledgeable informants on a scale of 0-3, X in an *interactive workshop* set-up rather than by judges (i.e. scientists) on a scale of 1 to 5 (or 1 to 7). Data collection involved members of the AIPs who are farmers (focus group discussions), management members of the AIP (key informant interviews), traders and agro dealers (key informant interviews) who are serving members of the AIP and knowledge providers of AIPs (key informant interviews). Below I provide a preliminary analysis of some of the findings from the study.

ADEM (Agência de Desenvolvimento Económico de Manica) ADEM (Agência de Desenvolvimento Económico de Manica) is an AIP that started working in partnership with SIMLESA in the 2013/2014 agricultural season. The AIP works in four districts, namely Manica, Macate, Nhamatanda, and Gorongosa in the scaling out of SIMLESA technologies and CA practices. ADEM is working with about 74 farmer associations, totalizing 9956 farmers (4039 women and 5917 men) in four districts. Another AIP, which provides similar services to farmers' organization as ADEM is UCAMA (Manica Province Farmers' Union), this organization represents all farmers from Manica province only. UCAMA works with 20 farmers associations from different villages in Manica, totalizing 500 farmers (250 men and 250 women). The two AIP have generated several benefits to the farmers.

The major benefits are highlighted below.

Increased crop production, as a result of adoption of CA technologies and increased access to credits:

Farmers access inputs, specifically improved varieties of maize and legumes from seed companies and Agro-dealers. Specifically, farmers in *Zano Ra Mambo* farmers' association, which is located in Macate district, have been able to access seeds, in input fairs promoted by ADEM. In these fairs, seed companies and agro-dealers, namely Dengo Commercial, IAV, and Agroserv, take their inputs to the villages, and sell them at low prices. A marketing company, namely Agro-trading Company also joined ADEM in providing seeds to farmers in credit form. After harvest, farmers paid back the company for the seeds they had received. Farmers were able to get access to drought tolerant maize varieties, including PAN53 and ZM309. Through demonstration plots of CA agricultural practices, organizes training of farmers, field days and exchange visits on crop production and post-harvest management. The increase in access of improved varieties of maize and legumes and the training of CA technologies has resulted in an increase in maize yield from 1500 kg/hectare in 2010 to 3000kg/hectares in 2015. This is 50 percentage yield increase in maize.

Luta contra pobreza which is a farmers group under the auspices of UCAMA AIP experienced a yield increase in maize production from 500 kg/hectare in 2012 to 2 tons/hectare in 2015. In addition, there was an increase in cow pea production from 50kg/hectare before SIMLESA demonstrations and activities to 200kg/hectare after demonstrations. All the noted above benefits for both ADEM and UCAMA resulted into improved food security and nutrition of the AIP members households.

Negative:
Gender and Social Inclusion: Men and women members of the farmers group(s) participate in most AIP activities. However, the level of participation of women in leadership positions is negligible, because women in the area under study are illiterate. In addition, the level of women's participation in exchange visits and field days outside their villages is low, because women do not have the same ability to quickly travel as men do because of households' responsibilities and having to take care of children.
Weather condition: Drought in the last two seasons (the end of 2015 and part of 2016) has affected yields of maize and cow peas; this indicates that having drought tolerant seeds (maize specifically) does not necessarily translates into high yield, when there is drought.
Markets: Farmers in some areas of Macate (Abelha farmers' association/group) noted that even though there are many traders of maize, the price farmers receive for maize is very low and not fair compared to the work and the money they put into their farmers.

Study 2: Agricultural Innovation Platforms and Gender Equity in Kenya
The study was carried out from August to October of 2016, the study sought to do the following: (i) investigate mechanisms of equitable generation and sharing of benefits among men and women members; and (ii) to document underlying success factors that are critical for the positive outcomes of Innovation platform. The study was done in six Agricultural Innovation Platforms (AIPs) in Kenya. The study documents broad benefits of the AIPs, including crops, business, and environmental, social and infrastructural related benefits. Same methodology that was used for similar study in Mozambique was applied in the Kenya study. Data collection involved members of the AIPs who are farmers (focus group discussions), management members of the AIP (key informant interviews), traders and agro dealers (key informant interviews) who are serving members of the AIP and knowledge providers of AIPs (key informant interviews). Below, I provide a highlight of one of the successful AIP in Kenya, namely Kyeni AIP.

Kyeni AIP was formed in 2011. Kyeni is located in Gatitika village, sub-location Kathanjuri, sub-county, Embu East and county Embu. The AIP has fourteen members, whom ten of them are women and four are men. The group is a produce of maize and beans.

Marketing and profit sharing
AIP members sell beans together. But maize is sold by individual farmers. Starting with beans, the AIP members, have one buyer who buy their produce. In addition, every member of the AIP is paid for the amount of beans s/he has put up for sale. Thus payment is paid to individual farmers for the kilograms bought. Moreover, when farmers market their produce together it eliminates the middle man/brokers fee, which provides a room for the farmers to sell their produce at a good price. Indeed, the price of beans offered by other traders who are not working closely with the AIP members is KESH 50/kg, while the price of beans offered by the trader who is working with the AIP is KESH 110/kg. Furthermore, produce now can be bought at a farm gate, because the buyer comes to buy from the AIP and not the AIP taking it to the buyer, which eliminates transport, time and other transaction costs. Following with maize, the maize variety Duma 43 is now the most common varieties, since it was introduced by SIMLESA. Before, joining the AIP, they were planting local varieties and DK 8031; the diversity of maize varieties has currently increased and now the group has a wider choice of varieties to choose from for planting

purposes. As a result of this, maize has become a main enterprise to bring income to the group members unlike before.

Credit access

Women enterprise fund, which is a government body that provide credit to the Kyeni group has assisted women to get finance to use for farming their individual farms and running the AIP activities. As a result of these funds [and provision of seeds in the mega plot training of CA technologies from Kenya Agricultural and Livestock Research Organization (KARLO)], has helped yields of beans to increase from an average of 540 kg/acre during the initial stages of the AIP to 720kg/acre during the last two seasons; this is 33 percentage increase in volume of production. The increase in yield has also helped to repay their credits. In addition, Equity bank is the main banker of the AIP, and it advices the AIP on financial matters. Lastly, the AIP members, share dividends from table banking equally for both men and women.

Negative:

An exchange visit by the AIP to another AIP gave them an idea to have an AIP mega plot (not only a demonstration plot) where they would grow crops together and sell together (as an agribusiness). The idea is well received, but the AIP have not been able to secure land to rent.

Study 3: Agricultural Innovation Platforms and Gender Equity in Tanzania

The study was carried out from September to December of 2016, the study sought to do the following: (i) investigate mechanisms of equitable generation and sharing of benefits among men and women members; and (ii) to document underlying success factors that are critical for the positive outcomes of Innovation platform. The study was done in six Agricultural Innovation Platforms (AIPs) in Tanzania. The study documents broad benefits of the AIPs, including crops, business, and environmental, social and infrastructural related benefits. Same methodology that was used for similar study in Mozambique was applied in the Tanzania study. Data collection involved members of the AIPs who are farmers (focus group discussions), management members of the AIP (key informant interviews), traders and agro dealers (key informant interviews) who are serving members of the AIP and knowledge providers of AIPs (key informant interviews). Below I provide a highlight of one of one of the broad success of AIP in Tanzania.

In Tanzania over half a dozen of the AIPs that were initiated by SIMLESA in 2014, have experienced increase in yield in maize and pigeon pea, mainly led by farmers participation in training on the importance of using improved varieties of maize and legumes and Conservation Agricultural (CA) farming techniques. A majority of the members of AIPs embraced better farming practices they received, when attending trainings (farm demonstrations) on improved agricultural technologies at village level, field days at village/district level, agricultural shows at national levels and those conducted by agricultural research institutions, specifically Selian Agricultural Research Institute (SARI). The table below shows the production trends before (2014) and after SIMLESA project intervention (2016). There has been an increase in maize and pigeon pea production due to the use of improved seeds and the use of better agronomic practices by farmers. However, bean yield has not been increasing, because farmers cannot access improved bean seeds, especially drought tolerant varieties from agro-dealers. Thus farmers cannot access improved bean seeds, especially drought tolerant varieties from agro-dealers. As a result of this farmers settle into recycling own seeds every year. Again increase in production was a result of adoption, which was a result of adoption of improved agricultural technologies. Increase in price of the crops is led by: (i) increased volume of production, which attracts traders to go to the AIP members and the villages to get high quantity of produce at one go; (ii) increased demand of produce in the international market especially for pigeon pea; and (iii) increased access to information as a result of information sharing among the AIP members, among others. Below are the increase in production trends, which both men and women members of the AIP were able to enjoy.

Table 1: Production trends before and after SIMLESA project intervention

AIP	District, Region	Crop name	Production (Bag=100-120 kgs/Acre)		Percent change in production	Price (Tsh/Bag)	
			Before the project (2014)	After the project (2016)		Before	Recently
Masqaroda	Mbulu, Arusha	Maize	6	8	33%	30,000	36,000
		Common bean	1.50	1.50	0%	80,000	90,000
Bargish-Uwa	Mbulu, Arusha	Maize	6	8	33%	30,000	36,000
		Common bean	1.5	1.5	0%	80,000	90,000
		Pigeonpea	1.5	1.5	0%	80,000	90,000
Bashay	Karatu, Arusha	Maize	5	10	100%	40,000	60,000
		Pigeonpea	3	8	167%	120,000	250,000
Rhotia Kati	Karatu, Arusha	Maize	6	10	67%	40,000	60,000
		Pigeonpea	4	7	75%	120,000	250,000
Dodoma Isanga	Kilosa, Morogoro	Maize	4.5	8.5	89%	30,000-45,000	30,000-45,000
		Pigeonpea	1.25	4.50	260%	60,000	75,000-120,000
Mandera	Kilosa, Morogoro	Maize	4	7.50	88%	28,000	36,000
		Pigeonpea	1.50	4.50	200%	70,000	120,000
Msingisi	Gairo, Morogoro	Maize	3.4	6.3	85%	28,000	67,000
		Pigeonpea	0.6	3	400%	100,000	260,000
Makuyu	Mvomero, Morogoro	Maize	2	7	250%	30,000	40,000
		Pigeonpea	1	5	400%	60,000	200,000

Study 4: Gender Analysis on Maize or Legume Value Chains, a Case Study of Kenya

The study was carried out from August to October of 2016, which aims to answer the following two questions: (1) Where and how can maize and legumes be scaled for sustainable intensification of maize-based farming systems? (2) What would the potential impacts be, in the medium term, across food systems in the four countries under study? The study analyzed the maize and legume value chain using a rapid assessment approach and the Integrating Gender into Agricultural Value Chains analytical framework. We used qualitative methods, focus group discussions and key informant interviews. The study was carried out in Western Region and Eastern region of Kenya. Data collection involved seed actors (key informant interviews), maize and legume producers (focus group discussions with men and women farmers), producer association (focus group discussions), retailers and processors (key informant interviews),local buyers and traders (key informant interviews), and export market buyers and traders (key informant interviews). Below I provide a preliminary analysis of some of the findings from the study.

Land acquisition is either through ownership by inheritance, renting or through purchasing. More than three fourth of the land is through inheritance, the remainder of it is through renting or purchasing. As producers in the Eastern and Western Regions of Kenya indicated, men have both customary rights and title deeds. Women only have joint rights to land usage. Women only get to make decisions when they are the head of their households. Customs and traditions demand that men, especially the household heads own the land. If they allocate them to women and youth, it is always for short-term crops. This limits the youth and women's ambitions to venturing in long-term enterprises.

As to whether decision to grow which type of maize seed are made by either man, woman or both, producers in Kanduyi (Western Kenya) noted that 60 percent of such decisions were by men, 20 percent were women while 20 percent of such decisions were made jointly by both men and women. However, in women headed households, women are the sole decision maker. In terms of marketing of the crops, as far as decision of whether a husband/man or wife/woman should be the one selling maize or legumes, in most cases we find different answers, which are specific to a crop. Specifically, decision to sell maize is always left for men, who are mostly the head of their households. Selling of maize is considered as a major decision and thus need to be left for men. In terms of legumes, women mostly decide on the selling price of beans. However, this is not the same case in some communities under study. As one of the producers from these communities noted, though beans are considered a women's crop, when it comes to selling, the decision is always left for men. Below, I provide general constraints faced by women and men for the maize and beans production and marketing; and for maize retailing and local processing.

General Constraints in Maize Production and Marketing

Production Challenges (Maize)		Marketing Challenges (Maize)	
Women	**Men**	**Women**	**Men**
Intensive land preparation	Lack of funds to finance maize production in terms of input purchase and hiring of extra labour	Inability to make decision on sale	Lack of interest when small quantities are available for sale
Poor access to extension information	Women over depend on men to supply input	Inability to participate in pricing	Poor maize grain price
Challenges presented by middlemen	Low production because less quantities of fertilizers are applied	Inability to access quality seeds	
Late availability of inputs			

especially from National and County Government			

General Constraints in Beans Production and Marketing

Production Challenges (Beans)		Marketing Challenges (Beans)	
Women	**Men**	**Women**	**Men**
Lack of money to purchase improved seeds	High Seed price	Women do not fully have the rights to sell what they plant sometimes,	Poor output market
Little knowledge of good crop varieties and field management practices	Identification of different bean variety	Transportation to the market.	Lack of interest in beans
Disrespect to women and destruction of their farms by animals (household head)			
Lack of funds to buy certified seeds and fertilizers			
Demand for labor			

Constraints in Maize Retailing and Local Processing

Local Processing	Retailing
Customers Seeking service for Free and on Credit	Low sales during harvesting times
Cough due to dust	Credit defaulters
Business is seasonal (only good during harvest)	Daily Levis and taxation
Stock may fail to clear (Backlog)	Price fluctuation
Direct purchase from farmers by customers	Low profit
Price fluctuation	Poor roads to transport maize
Low profit	Difficulty in drying during rainy season s
High moisture content	Delayed payments
Daily Levis and taxation	

Constraints in Legume Retailing and Local Processing

Local Processing	Retailing
Scarce raw materials for processing groundnuts	Low sales during harvesting times
Lack of capital for groundnuts	Credit defaulters
KEBS standardization requirement makes it difficult to penetrate the high end market such as supermarket.	Daily Levis and taxation

Low yields	Price fluctuation
	Low profit
	Poor roads to transport beans
	Delayed payment

Study 5: Gender Analysis on Maize or Legume Value Chains, a Case Study of Mozambique

The study was carried out from October to December of 2016, which aims to answer the following two questions: (1) Where and how can maize and legumes be scaled for sustainable intensification of maize-based farming systems? (2) What would the potential impacts be, in the medium term, across food systems in the four countries under study? The study analyzed the maize and legume value chain using a rapid assessment approach and the Integrating Gender into Agricultural Value Chains analytical framework. We used qualitative methods, focus group discussions and key informant interviews. The study was carried out in Macate (Western Region) and Angonia (Central Region) districts. Data collection involved seed actors, maize and legume producers, producer association, retailers and processors, local buyers and traders, and export market buyers and traders. Below I provide a preliminary analysis of some of the findings from the study.

Preliminary findings of the study shows that in terms of land ownership, few people have title deeds and user rights, some have customary rights. For the few people with title deeds and land use rights are in the name of the men, because men is the decision maker within the household. However, in matrilineal side of the Mozambique, because men lives at the wife's house after marriage, the land he finds belongs to the wife. In terms of the decision of the size of the land to allocate for maize production, producers provided mixed answers, which are, in most cases the tasks falls on men, but in few cases it is both men and women. On the other hand, there are some few exceptions, in cases of female headed households, in these households, women tend to make decisions of the size of the land to plant maize on their own. Furthermore, in other villages, some men and women farm in separated plots, and this is done on purpose, in order to make sure that the household is food secure, because some men in these villages sell their production and buy alcohol. So when each farmer farm in their own plot, each spend and control the product according to the needs.

In terms of decision in selecting maize varieties, there are couple of answers, in some cases, men make the decision in selecting maize varieties, and in others, both men and women make decision jointly to help each other make the best choice and all be responsible if anything goes wrong. On the other hand, women are responsible for most of the legumes, as they are heavily involved in the whole legume production process.

With regards to marketing and selling, in most cases men are main decision maker when it comes to selling of maize, as they are the head of the household. Moreover, only women head of household can make decision to sell maize. In terms of the selling of legumes, in most cases it is women who have an upper hand in terms of selling of legumes. On the aspect of purchasing of maize seeds for the households, in some communities' wife and husband buy seeds together, in others husbands buy the seed alone, and finally in most cases, women are the ones who go to buy maize seeds, because men can spend the money drinking. Lastly in terms of knowledge and training for maize and legume production, men are more likely to participate in trainings and technical meetings, because most of the trainings take place outside the village, which women find hard to attend, because they need to stay at home to take care of children.

Study 6: Characterizing Smallholder Maize Farmers' Production and Marketing in Kenya: An Insight into the Intra-household Gender, Wealth Status and Educational Dimensions.

This study examines production and market participation patterns among poor, averagely wealthy, the relatively wealthy, formally-educated and non-educated Male Headed Households (MHHs) and Female Headed households (FHHs) in Kenya. Wealth categories of the households were based on aggregate wealth derived from an asset index computed through the Principal Component Analysis method. Using the Sustainable Intensification for Maize and Legumes in Eastern and Southern Africa (SIMLESA) dataset, a random sample of 594 maize producing households were interviewed using semi structured questionnaires. Both quantitative and qualitative methods were used for data analysis. The results showed that; more than half of the respondents didn't sell their produce, close to half of the farmers who sold maize use farm gate market channel, and more than half of the relatively wealthy households were selling their maize. Further, over three quarters of farmers who applied for credit did not receive it; detailed analysis showed a higher rate of non-market participation for households that did not get the requested amount of credit. Close to two-thirds of the households that received the amount of loan they requested for participated in the market and of the total households that got the requested amount of loans only 15 percent were female-headed. These findings imply that there is need to sensitize farmers on the benefits of commercialization, similarly extension officers should iterate the benefits of participating in high value markets to poor farmers. Credit targeting through seasonal loans and loans that require less collateral may increase smallholder farmers' access to credits. Notably female producers should be encouraged to embrace social capital through formation of group so as to access markets and credit.

Ongoing Studies: There are other ongoing studies, which are similar to study 1 through 5, which are taking place in Malawi and will be taking place in Ethiopia. The studies are AIPs and Gender Equity, and Gender Analysis on Maize or Legume Value Chains.

Capacity Building: Currently, we have two Masters Students, who are pursuing Agricultural and Applied Economics degree at University of Nairobi. The first student, namely Jessica Osanya, her thesis is titled "An Assessment of Gender Roles in Farm Decision-Making and their Effect on Maize Production Efficiency in Kenya." Ms. Osanya is using Kenya Households and Individual Adoption Pathways Responses, collected in 2013 to carry out her study. Ms. Osanya is expecting to graduate in May, 2017. The second student, namely Mr. Dennis Olumeh, his thesis is titled, "Determinants of Market Participation in Male and Female Maize Farmers in Kenya." Mr. Olumeh is using Mozambique and Kenya household SIMLESA datasets collected in 2010/2011, to carry out his study. Mr. Olumeh is expecting to graduate in August, 2017. The students are both Kenyans.

Article to be published

Product #1: Accepted paper to the **Development in Practice** journal:

"The Situation of Women in Agribusiness Sector in Africa"

Manuscript ID is CDIP-2016-0092. [The paper was submitted on July, 17th, 2016, Resubmitted for publication on the 10th of January, 2017].

Product #2: Submitted paper to the **Development in Practice** journal:

"Gender and Equitable Benefit Sharing Mechanisms through Agricultural Innovation Platforms".

Manuscript ID is CDIP-2016-0091.

Articles in draft format:

Product #3: Gender Analysis on Maize Value Chains, a Case Study of Tanzania.

Product #4: Gender Analysis on Legume Value Chains, a Case Study of Tanzania.

Annex 4: CIAT report

Semi- Annual Technical report on Sustainable Intensification of Maize-Legume Cropping Systems for Food Security in Eastern and Southern Africa (SIMLESA-II) activities carried out by CIAT

Period: July 2016 to December 2016

PI: Job Kihara

During the reporting period, CIAT has organized and facilitated shipping of soil samples for several exploratory CA trial fields from Malawi to Nairobi and pre-processed these for chemical analyses. Also, CIAT has continued to sample and analyze soils for mineral nitrogen from SIMLESA trials in Eastern and Western Kenya, and undertaken in-depth soil biology investigations with regard to presence and diversity of microbial, meso- and macro-fauna in additional two trials in Western Kenya (one is a 6-year and the second a 13-year old trial). The data from the latter have been analyzed jointly with similar data from Eastern Kenya taken during the previous reporting period. At the same time, lysimeters to measure leachates have been installed in the 6-yr KALRO Kakamega trial, as well as temperature loggers in CIAT's 13-yr CA trial in western Kenya. We provide here activities undertaken during the reporting period.

Activity 2.1.1: On farm exploratory trials

Soil samples at 0-5 cm, 5-20 cm and 20-50 cm depths for the mid-altitudes of Malawi for two sites, Kasungu and Mchinji specifically for 3 treatments namely (1) conventional ridge and furrow, (2) CA dibble stick no herbicide and (3) CA dibble stick maize phase of the maize-soya rotation and six farmers per community have been shipped to CIAT laboratories in Nairobi and pre-processed for analysis. The soil analysis here is from good quality on-farm trials implemented consistently over 4-5 years in Southern Africa.

Activity 2.2.1: On station long term CA trials

Results and progress of the relay-cropping trial designed jointly by CIAT, CIMMYT and Mozambican national partners are reported by the national partners. In general, the relay crops establish and provide excellent soil cover, a good solution to the termite problem in this region of Mozambique. However, the trial on relay-intercropping with lablab established in Tanzania (Babati), initiated to compare with results from the trial in Mozambique was affected by poor growth of the relays due to severe soil moisture constraints. The trial is ongoing.

CIAT continues to undertake soil sampling and conduct assessments based on the specific soil-related questions for CA systems framed based on SIMLESA-2 project document. With regard to residue x N interactions, CIAT continues to work together with KALRO and is undertaking sampling in two newly established trials (one in Embu and Kakamega) which offers excellent opportunity to study this aspect. In line with this, soil sampling for mineral N (including from leaching), carbon and soil functional groups analysis has been undertaken for the long-term trials in western Kenya (one at KALRO-Kakamega and another at 13-yr CIAT CA trial).

Effects of tillage and residue management on soil fauna were shown for two experiments in Embu, eastern Kenya in the previous report. In this report, we show similar work done in two additional trials in western Kenya (a 6-year trial in KALRO Kakamega and 13-year trial managed by CIAT in Nyabeda, Siaya County; Table 1). This makes a total of 4 conservation agriculture trials implemented for 3 to 13 years that have now been fully characterized and treatment effects with regard to soil meso- and macrofauna determined. Methods and approaches are similar to those reported earlier for Embu.

Table 1. Treatment selected and descriptions

Nyabeda long-term trial				
FP (Farmer practice)	Conventional	Sole maize	None	None
CTMSr+CR	Conventional	Maize-soybean rotation	2 t/ha maize residues	60 kg N/ha-Urea
ZTMSr+CR	Zero	Maize-soybean rotation	2 t/ha maize residues	60 kg N/ha-Urea
ZTMSi+CR	Zero	Maize-soybean rotation	2 t/ha maize residues	60kg P/ha-TSP
Kakamega long-term trial				
FP (Farmer practice)	Conventional	Sole maize	None	None
CTMBi+CR	Conventional	Maize-bean intercrop	2 t/ha maize residues	50N, 25P
ZTMBi+CR	Zero	Maize-bean intercrop	2 t/ha maize residues	50N, 25P

Overall, a total of 59 macrofauna species classified into 15 major groups were found across the trials. The long-term trial had relatively higher species richness compared to the short-term trial, with number of species being 32 in Nyabeda and 27 in Kakamega. Previously, these had been 38 in the Embu long-term trial and 25 in Embu short-term. For mesofauna groups, 17 species classified into six major groups were observed across the four trials, and the western Kenya sites (Nyabeda and Kakamega) had relatively higher mesofauna richness compared to the eastern Kenya (Embu) sites. The specific groups and their abundance in the different sites has been documented in a submitted journal publication[1].

The combinations of tillage practice, organic residues and cropping system had significant effect on macrofauna taxonomic richness ($p < 0.05$) largely at the top 0-15 cm soil depth than at the lower 15-30 cm soil depth in most of the study sites (**Table** 2). At Nyabeda, macrofauna richness was significantly higher in both conventional (CTMSr+CR) and zero till (ZTMSr+CR) practices under maize-soybean rotation, but both with crop residues added than conventional (typical farmer's practice) till without inputs. At Kakamega, no significant differences were noted for macrofauna mean richness mean abundance among the treatments at both 0-15 cm and 15-30 cm soil depths**.** In addition, no significant differences were noted for mesofauna mean richness among the treatments at both 0-15 cm and 15-30 cm soil depths in all study sites except Nyabeda. As expected, soil fauna richness reduced with depth where these were nearly ≤50 % that of top soil for each of the treatments.

Table 2. Macrofauna and mesofauna diversity (richness) across long-term and short-term trials of Embu, Nyabeda and Kakamega

Macrofauna			Mesofauna		
---Nyabeda---					
Treatment	**0-15 cm**	**15-30 cm**	**Treatment**	**0-15 cm**	**15-30cm**
Farmer practice	2b	3.7ab	Farmer practice	4.3	3.0
CTMSr+CR	8a	5.3a	CTMSr+CR	5.3	5.7
ZTMSr+CR	7a	2.7b	ZTMSr+CR	4.3	2.3
ZTMSi+CR	5ab	2.7b	ZTMSi+CR	4.7	3.3
***p*-value**	**0.038***	**0.050***	***p*-value**	0.429	0.125
---Kakamega---					
Farmer practice	5.7	5.0	Farmer practice	2.0	2.0
CTMBi+CR	6.7	5.3	CTMBi+CR	3.7	3.7
ZTMBi+CR	11.3	7.0	ZTMBi+CR	5.7	2.3
***p*-value**	0.384	0.417	***p*-value**	0.058	0.502

Across sites, and in both (0-15 and 15-30 cm) soil depths, no significant effect of tillage, cropping and organic inputs on soil macrofauna and mesofauna abundance were observed except for Kakamega. Here, maize-bean intercrop system under zero till with residue applied (ZTMBi+CR) had significantly higher mesofauna abundance than the convention till with similar management (CTMBi+CR) practices or conventional till (farmers practice) without any inputs (**Table** 3).

Table 3. Macrofauna and mesofauna abundance across long-term and short-term trials of Embu, Nyabeda and Kakamega

Macrofauna			Mesofauna		
---Nyabeda---					
Treatment	**0-15 cm**	**15-30cm**	**Treatment**	**0-15 cm**	**15-30cm**
Farmer practice	107	203	Farmer practice	1814	970
CTMSr+CR	672	133	CTMSr+CR	4219	3080
ZTMSi+CR	395	107	ZTMSi+CR	4684	1224
ZTMSr+CR	496	149	ZTMSr+CR	2954	759
***p*-value**	0.203	0.927	***p*-value**	0.321	0.318
---Kakamega---					
Farmer practice	219	171	Farmer practice	633b	338
CTMBi+CR	336	192	CTMBi+CR	844b	1224
ZTMBi+CR	1163	272	ZTMBi+CR	4937a	1097
***p*-value**	0.089	0.546	***p*-value**	**0.030***	0.372

A site ordination by PCA/RDA biplot, representing the correlation square of the first two axes is presented in Figure 1. These axes separated objects (soil fauna groups) as a function of management (tillage, cropping system and residue application) practices across sites. Sum of all canonical eigenvalues reveal that management practices explained 34% of the total variation observed in macrofauna abundance and 52% of that in mesofauna abundance. The test on all canonical axes indicated treatment and site effects to be highly significant ($p < 0.001$). In other words, management affected most of the soil fauna groups as shown by the site effect upon both axes. Overall, the projection of soil fauna groups on the principal component analysis (PCA/RDA) ordination axes indicates that conservation (zero) till systems with crop residues added had on average higher soil fauna abundance than the conventional till systems, especially those without crop residues applied (Figure 1A and 1B). Further, the ordination plots show Eastern Kenya (Embu) sites opposing Western Kenya (Nyabeda and Kakamega) sites along axis 2 for the macrofauna groups (Figure 1A), and also along axis 1 for mesofauna groups (Figure 1B). Generally macrofauna groups were on average more abundant in the Eastern Kenya sites than in Western Kenya sites, but on the contrary, a reverse trend was observed for mesofauna groups.

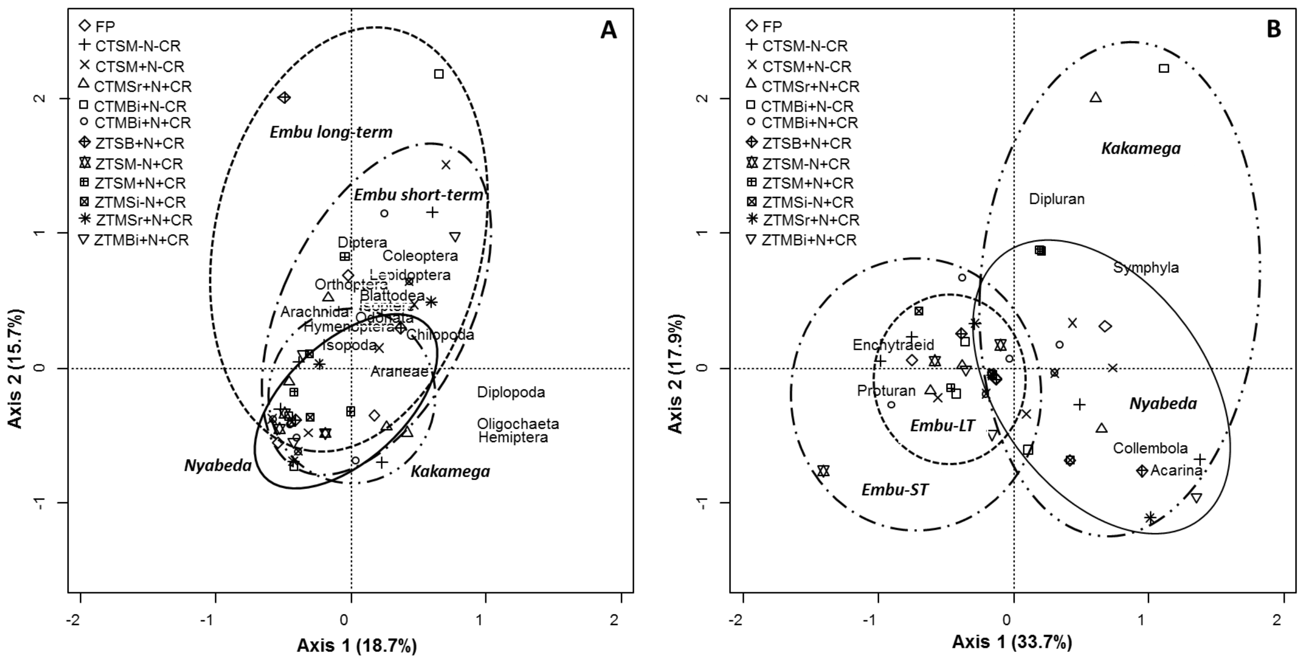

Figure 1. Projection of soil fauna: (A) Macrofauna and (B) Mesofauna along the two principal component (PCA/RDA) axes across different treatments and sites. LT: long-term, ST: short-term.

CIAT is in close contact with CIMMYT colleagues in Kenya who have also undertaken similar soil macrofauna assessments in other SIMLESA trials in Kiboko and Kakamega, together providing a rich data on this aspect.

Soil Physical properties: Effects of CA on soil moisture accompanied by soil temperature measurements continue to be assessed. This was done for a whole season in Embu (Kenya) and now being undertaken for a second season in Western Kenya. Besides, soil aggregation analyses have been recently completed to understand effects of CA on soil structure both in Eastern and western Kenya. We will undertake statistical analyses of these data within the next reporting period. Preliminary analyses indicate a clear improvement in aggregate mean weight diameter (MWD) following the practice of CA in KALRO-Kakamega. Further, intercropping of maize and soybean is leading to elevated MWD relative to maize and soybean grown in succession (rotation system) in a 13-yr long-term trial in Siaya County of western Kenya, both on top and subsoils. As expected, aggregate MWD increase with soil depth.

***Long-term trends in organic carbon*:** Soil organic carbon for a long-term trial (16 years since establishment in western Kenya) where over 500 samples were analyzed, was reported in the last period. Here, we report on active total carbon for short-term (3 yr) CA trial in Embu, eastern Kenya. Here, Active carbon is affected by depth ($p \leq 0.001$; **Table** 4) but not by treatments. Both active and total carbon decrease with depth. Active carbon below 30 cm depth is lower than at higher depths. On the other hand, total C for the very top soil (0-10 cm) is higher than at below 30 cm depths while also 30-60 cm depth has more carbon than 60-90 cm depth. During the period when the trial was in place, maize monoculture was grown. Maize plants have characteristic long fibrous roots which have the potential to reach deep horizons particularly in the loose nitisols.

Table 4: Effect of depth on Active and Total carbon

DEPTH (cm)	ACTIVE C	TOTAL C (%)
0-10	0.07	2.02
10-30	0.07	1.9
30-60	0.05	1.69
60-90	0.03	1.22

Activity 2.2.3: Non responsive soils / micronutrients

Extensive reporting on this activity has been made in the last reporting. The work was submitted to journal (Agronomy for Sustainable Development), first round of revisions made and re-submitted[2]. During revisions, further review was conducted resulting in expansion of the micronutrient-crop response database. Publications included and response ratios observed in each are shown in **Figure** 2 below. In general, the study shows response to micronutrients in most of the encountered studies, sites and soils.

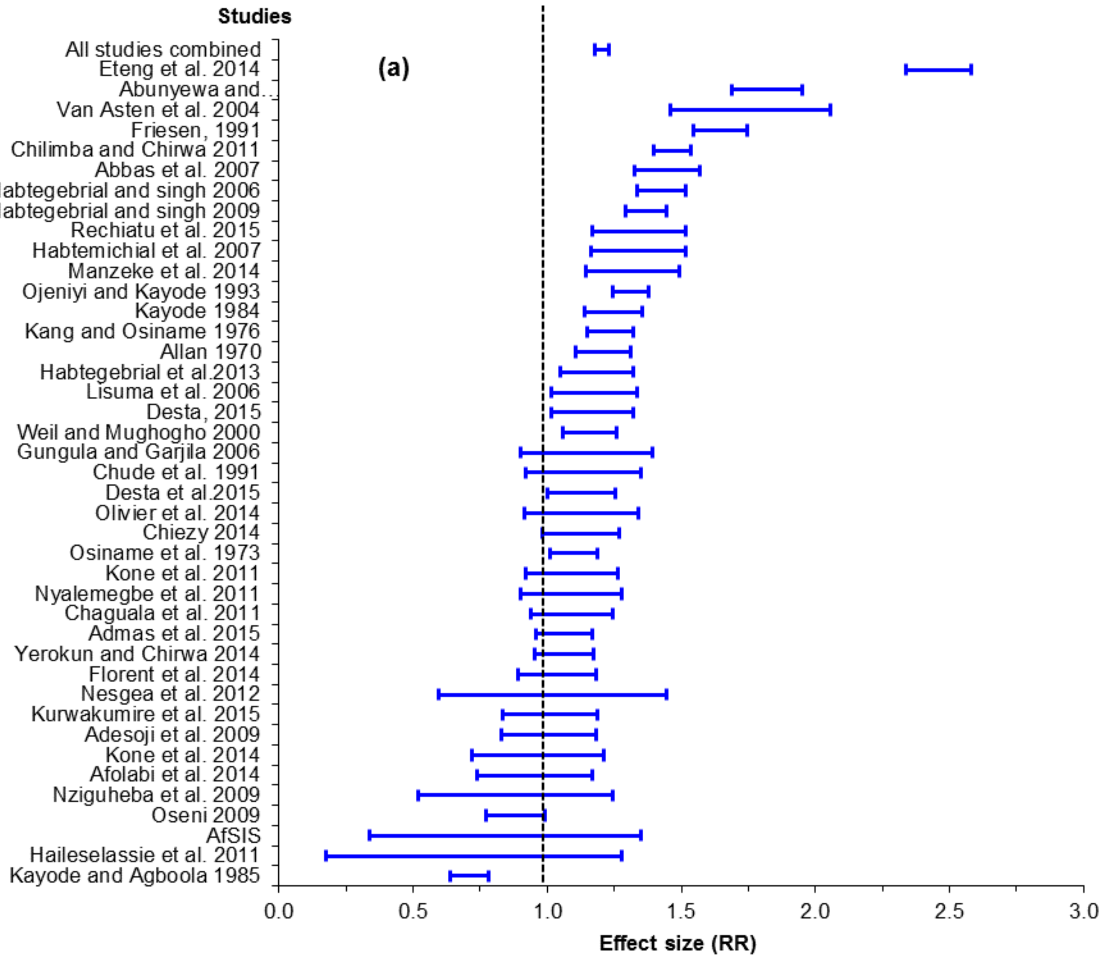

Figure 2. Forest plot of response ratios to micronutrient applications observed under different studies in SSA.

Activity 2.2.4: Nitrogen management

We indicated in the previous report on focus and preliminary results regarding to (i) assessing the status of inorganic nitrogen in different treatments at specific sampling periods in conservation agriculture relative to the conventional tillage and (ii) examining the extent of nitrogen leaching under the different amounts of residue and nitrogen management in Embu County. Further analysis has been done in this reporting period. Leached nitrate is affected ($p \leq 0.05$) by treatment but not by growth stage or the interaction between these factors. Application of nitrogen increased leached nitrate by 3 to 6 times that in control (unfertilized) treatment (Table 5). Treatments with nitrogen application had similar amounts of leached nitrate. Only leached nitrate under zero tillage (3R+80N) was higher ($p \leq 0.05$) than in the control treatment (conventional tillage with no N). Elevated leached nitrates in fertilizer treatments is expected following applied nitrates in fertilizer. Net mineralization/immobilization by residues in this young conservation agriculture systems does not yet contribute to nitrate leaching.

Table 5: Effect of treatments on leaching of nitrates

TREATMENTS	NITRATE LEACHED (mg/l)
CT0R+0N (Control)	8.73^{c}

CT0R+80N	27.74[abc]
CT3R+80N	36.51[abc]
ZT3R+80N	49.91[a]
ZT3R+120N	26.99[abc]
ZT5R+80N	37.11[abc]

Further, within the SIMLESA trial at KALRO-Kakamega, lysimeters were installed and leachate samples taken at four different crop growth stages. These are accompanied by depth-wise mineral N sampling. Laboratory analysis is on-going and the results will be shown in the subsequent reporting.

Effects on soil mineral N content

As expected, soil mineral N varied by growth stage ($P<0.05$) and was in the order V0>V8>V10=R4 (Table 6). It also reduced with depth ($p\leq0.05$; 0 to 10 cm> 10 to 30 cm> 30 to 60 cm = 60 to 90 cm) for all growth stages except V8 when increase by depth was observed (i.e., significant ($p\leq0.05$) interaction between depth and growth stage). Higher top-soil mineral N is attributed to mineralization of crop residues and other organic matter (like weeds) deposited and/or applied on or near the soil surface, applied fertilizers etc. A birch effect may be responsible for the higher mineral N at the topsoil during V0 growth stage while increased mineral N movement down the soil depth with soil water is likely responsible for elevated mineral N at lower depth in V8 growth stage. There was consistent rains during the period preceding the soil sampling at V8 (top dressing had been done at V6). Highly reduced mineral N at V10 and R4 is explained by high uptake of N by crops and reduced moisture to facilitate mineralization at a time when no more topdressing was occurring. Though N levels in R4 are low, the crops requirement of N supply from the soil is negligible.

Table 6: Effect of depth and growth stage interaction on soil mineral N

DEPTH	GROWTH STAGE			
	V0	**V8**	**V10**	**R4**
0-10	21.9[a]	9.4[b]	6.2[a]	7.9[a]
10-30	13.8[b]	8.3[b]	5.5[ab]	6.7[ab]
30-60	6.7[c]	10.7[ab]	4.4[b]	4.6[b]
60-90	3.7[d]	12.3[a]	4.3[b]	4.0[b]

Column of means with the same letter are not significantly different ($p\leq0.05$)

Besides depth and growth stage, soil mineral N amount was affected ($p\leq0.05$) by treatments and its interaction with growth stages (Table 7). Overall (i.e., aggregated over sampling times), greater ($P<0.05$) mineral N was observed in conventional tillage (with N added) than in control and the zero tillage treatments. At individual growth stages, there were no differences in mineral N at later growth stages (V10 and R4) but only in earlier ones (R0 and V8). At V0, both conventional treatments with fertilizer had higher mineral N than all zero tillage treatments. There were no differences among the zero tillage treatments. Also, among conventional tillage treatments, application of N without residues resulted in higher mineral N than control, an observation not made when residues were also applied. Similar trends were observed for mineral N at V8 with the exception that here, mineral N was higher than the control even for the conventional tillage treatment where application of nitrogen was accompanied by chemical nitrogen application. Therefore, surface application of residues (zero tillage) locked available mineral N and increasing N application (from 80 to 120 kg N/ha) did not further increase soil mineral N except for insignificant increases at V10. Secondly, that conventional tillage treatments results in elevated mineral N even for unfertilized control at planting indicates elevated birch effect under CT than under zero-tillage (i.e., effects of first rains following land cultivation). Third, elevated mineral N at planting may result to increased inefficiencies. Lastly, application of residues in conservation agriculture causes short-term N immobilization in the system (i.e., at the very early growth stages) but not later. In the Embu case, incorporation of residues has insignificant effect on mineral N under conventional tillage system.

Table 7: Effect of treatment and growth stage interaction on soil mineral N

TREATMENT	GROWTH STAGE			
	V0	V8	V10	R4
CT0R+0N	11.5^{bc}	8.9^{c}	4.5^{a}	5.3^{a}
CT 0R+80N	13.2^{a}	12.4^{a}	4.9^{a}	5.6^{a}
CT 3R+80N	12.2^{ab}	11.7^{ab}	5.6^{a}	5.8^{a}
ZT3R+80N	10.8^{bc}	8.7^{c}	4.8^{a}	6.2^{a}
ZT 3R+120N	10.3^{c}	9.4^{c}	6.0^{a}	5.9^{a}
ZT 5R+80N	9.8^{c}	10.1^{bc}	4.6^{a}	5.7^{a}

Columns with the same letters are not significantly different (p≤0.05)

Activity 2.3.2: Recommended domains for soil health management

No activity in this reporting period.

Activity 2.3.3: Monitoring protocol for on farm experiments

No activity during this reporting period.

Partnerships: In our reported CIAT - KALRO (Dr. George Ayaga) created through SIMLESA, full DNA illumina sequencing has been undertaken for 11 CA/CT practices derived from the KALRO-Kakamega CA trial initiated through SIMLESA and CIATs' long-term CA trial in western Kenya. This is the first full DNA sequencing on CA practices that we are aware of so far in SSA. Analysis of the data is ongoing.

Journal Publications under review

Ayuke, F.O, Kihara, J, Ayaga, G. and Micheni A. Conservation agriculture enhances soil fauna diversity and abundance in low input systems of Sub-Saharan Africa. Submitted (December 2016) to Soils and Tillage Research journal.

Kihara J., Sileshi W. Gudeta, Nziguheba G., Kinyua M., Zingore S., and R Sommer. Application of secondary nutrients and micronutrients increases crop yields in sub-Saharan Africa. Accepted (with revision) Agronomy for Sustainable Development journal.