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SIMLESA Highlights

Bulletin

The Deputy Director of the Kenya Agricultural Research Institute (KARI), Dr. Joseph Mureithi (center), at the SIMLESA Kenya Scaling-out Planning Meeting. Looking on are SIMLESA program coordinator, Mulugetta Mekuria (right) and Stephen Njoka, KARI-Embu Center Director (left).

Kenya meeting: Planning for SIMLESA technologies to reach 650,000 households by 2020

An intense SIMLESA-Kenya annual review and planning meeting at the facilities of the Kenya Agricultural Research Institute (KARI) during 4-6 November 2013 focused on strategies for "scaling-out" – that is, broadening the adoption of SIMLESA technologies – with the participation of strategic partners including KARI, CIMMYT, seed companies, farmer organizations, extension services, non-governmental organizations (NGOs) and a crop insurance company.

Following similar meetings in Malawi, Mozambique and Tanzania and field visits in Ethiopia, this type of event is crucial for the project's transition from Phase I to Phase II and, particularly, to discuss efforts to foster widespread adoption of more productive and sustainable cropping systems in Sub-Saharan Africa, according to Mulugetta Mekuria, SIMLESA program coordinator.

"We intend to reach 650,000 households by the year 2020 in the five participating SIMLESA countries," said Mekuria. "We need scaling-out strategies and work plans to build private and public partnerships with government extension services, NGOs, community organizations and seed companies." According to Mekuria, technology development components are progressing on schedule, but SIMLESA faces strong challenges to generate and evaluate technologies while accelerating adoption to achieve impact targets.

Joseph Mureithi, KARI Deputy Director and member of the SIMLESA Program Steering Committee, thanked SIMLESA for helping KARI and its partners to implement a project that will contribute to food security, a right that is enshrined in Kenya's constitution. "Kenya produces 30 million bags of maize, but the nation requires 40 million bags to be self-sufficient in this essential food crop," Mureithi said.

Participants from Kenya's Embu and Kakamega regions reported on activities, reviewed their plans and shared their strategies to scale-out useful knowledge and products.

A publication of the Sustainable Intensification of Maize-Legume Systems for Food Security in Eastern and Southern Africa (SIMLESA) Program

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ETHIOPIA KENYA MALAWI MOZAMBIQUE TANZANIA AUSTRALIA

Agronomy training in South Africa for SIMLESA scientists

Fifteen young scientists from SIMLESA partner and spillover countries attended a course at South Africa's Agricultural Research Council (ARC) during 6-17 May 2013 on various aspects of agronomy and innovation and learning platforms, including conservation agriculture principles, nitrogen fixation, experimental design and field layout, agro-climatology principles and data collection and analysis.

The training took place at the ARC institutes for soil, climate and water (ARC-ISCW), plant protection research (ARC-PPRI) and grain crops (ARC-GCI). Planned to expose the scientists to grain production information and to enable the learning of terms, theories and principles through practice, the course applied experiential learning principles and diverse interactive learning methods, scientific presentations, discussions, lab practices and field demonstrations. Visits to companies such as SOYGRO, which manufactures rhizobium inoculant and related products, provided perspectives on the national grain industry from manufacturing and packing to distribution.

Trainees also attended Nampo Harvest Day, a major agricultural show in Bothaville, Free State, which is one of the largest privately organized and owned exhibitions in the world, the largest agricultural machinery and livestock show in the Southern Hemisphere and brings more than 650 exhibitors from all over the world.

In a visit to the Unit of Environmental Sciences and Management at North-West University, Professor Driekie Fourie introduced the trainees to the university's research programs and related study fields. Before the trip, Professor Johnny van den Berg from the university gave an introductory talk on integrated pest management. The program was coordinated by Fred Kanampiu, CIMMYT agronomist; Yolisa Pakela-Jezile, ARC-Senior Manager, Training Services; and Annelie de Beer of ARC-GCI. Participants are expected to use their newly acquired knowledge and skills to train their colleagues.

Tanzania planning meeting: More innovation platforms to be established

At a SIMLESA-Tanzania planning meeting in Arusha during 8-10 October 2013, participants resolved to increase the number of innovation platforms to foster the spread of more productive and sustainable cropping systems and improved crop varieties. Dr. Fedelis Munyaka, the Director of the Department of Research and Development in Tanzania, said SIMLESA has contributed a great deal in capacity building, as well as building research infrastructure and knowledge. He noted that the Tanzanian government had worked well with SIMLESA teams and observed that new seed varieties had been developed and introduced by SIMLESA in Tanzania. He also stated that the government is willing to adopt selected SIMLESA strategies in the agricultural sector. Myaka pointed out the need to consider the whole value chain in the next phase of the program, strengthening both input and output marketing systems, and noted that the government was striving to improve markets. He thanked CIMMYT, the Australian Centre for International Agricultural Research (ACIAR), the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), NGOs and others for complementing the government's effort in sustainable development. Meeting participants included SIMLESA leadership team members Fred Kanampiu, Michael Misiko and Mulugetta Mekuria. George Mburati, an ACIAR consultant, was also in attendance.

A word from the program coordinator

I am happy to share with you this issue of the *SIMLESA Bulletin*. It contains information on what we are collectively accomplishing, as well as articles and photographs that capture the essence of our field and capacity-building activities. During the reporting period, we organized various capacity-building activities, including workshops on writing, data analysis and agronomic principles and practices, as well as training for technicians on mainstreaming gender concerns and approaches. We have strengthened local innovation platforms and conducted monitoring and evaluation tours, including field days.

I am particularly happy to publish this issue after the annual review and planning meetings held in Ethiopia, Kenya, Malawi, Mozambique and Tanzania. Emphasizing the scaling-out of SIMLESA technologies to many farmers and culminating in 2013-14 work plans, the meetings underscored the importance of effective communications approaches to reach all stakeholders and featured informative presentations and intense deliberations. As we complete Phase I and hopefully move to Phase II, scaling-out should embrace innovative approaches. The world is changing. We have new technological developments; information travels at unprecedented speed because of the Internet. The world is actually a global village.

Finally, I am pleased to announce a new approach to enhance the relevance and readability of the *SIMLESA Bulletin*. We will continue to share information from my desk, but going forward we are encouraging and will enable all readers and stakeholders to use this as a platform for shared communications. We want to learn how SIMLESA is impacting you and the intended beneficiaries. We want to hear farmer testimonies. Please share your ideas and stories with Wandera Ojanji (w.ojanji@cgiar.org) and we will include them in the *SIMLESA Bulletin*.

Finally, please add to your calendars the 4th Annual Review, Planning and Program Steering Committee Meeting (ARPM), to be held 7-11 April 2014 in Addis Ababa, Ethiopia, and hosted by SIMLESA Ethiopia.

Thank you for being part of the SIMLESA family. We value you!

Mulugetta Mekuria

Program coordinator, SIMLESA

SIMLESA scientists gather in Harare to write up research results

Twenty-two scientists from four of the five SIMLESA countries – Kenya, Malawi, Mozambique and Tanzania – gathered at the Pandhari Hotel in Harare, Zimbabwe, during 1-6 July 2013 for a workshop to synthesize and draft papers on SIMLESA agronomy activities. Backstopped by a facilitator and supported by CIMMYT scientists Fred Kanampiu, Dan Makumbi, Walter Mupangwa and Isaiah Nyagumbo, the event provided an opportunity for participants to fine-tune their scientific writing skills and to have their draft papers peer-reviewed by experts.

Scientists who attended the Harare training.

"I wish we had started this kind of meeting a year ago," said Alfred Micheni, KARI researcher and SIMLESA site coordinator for Embu. Other participants said the workshop offered a unique opportunity for national agricultural research system partners to showcase their work as lead authors.

By the end of the week at least 18 papers had been drafted and reviewed. The workshop helped to build confidence among participants and served as a foundation for capacity-building in writing scientific articles. Timelines were set for co-authors to share drafts with their peers and for objective leaders to review the drafts before the facilitator provides final feedback.

Mozambique maize technicians hone their capacity

Participants at a SIMLESA training in Mozambique.

Forty maize technicians from various agricultural research stations, private seed companies and community-based seed production (CBSP) schemes attended a training course in Chimoio, Mozambique, during 1-12 July 2013. Enabling participants to produce quality seed and conduct on-station and on-farm trials, it combined classroom and practical sessions covering seed production, breeding for biotic and abiotic stresses and trial layout using the alpha lattice design.

The course was organized jointly by the Drought Tolerant Maize for Africa (DTMA) project, SIMLESA and the U.S. Agency for International Development (USAID) office in Mozambique, in collaboration with the *Instituto de Investigação Agrária de Moçambique* (IIAM). SIMLESA representatives emphasized the need for on-farm testing using the mother-baby trial approach (comprising a main trial at a central location in the community and subsets in farmers' fields) and conservation agriculture principles. USAID-Mozambique and DTMA focused on the importance of producing quality seeds and multiplying enough seed to reach smallholder farmers.

Mozambique recently released two drought-tolerant maize hybrids and one early-maturing open-pollinated variety (OPV) as part of DTMA. Having few seed companies, Mozambique sources most seed from the informal sector. The training was timed to coincide with the beginning of seed production of newly released OPVs by several communities.

The course was coordinated by Cosmos Magorokosho and Peter Setimela from CIMMYT, who teamed with Pedro Fato and David Mariote from IIAM.

Tracking adoption patterns in maize

Myths and cultural practices can block farmers' acceptance of a new technology, particularly the principles of reduced tillage, residue retention and cropping rotations that underlie conservation agriculture. This was one observation in a visit to farmers in four districts in Ethiopia by Mellissa Wood, Australian International Food Security Centre (AIFSC) director, and Dennis Bittisnich, AIFSC Biosecurity and Food Safety Manager, in July 2013.

Farmers in one village who continued intensive tilling instead of conservation agriculture (CA) said that tillage helps control crop diseases. Many Ethiopian farmers also keep livestock, so crop residues have higher value as fodder for cows than as cover for soils. "Maize stover is also used as fuel for cooking fires," said CIMMYT socio-economist Menale Kassie, who is also regional leader for the Adoption Pathways to Sustainable Intensification in Eastern and Southern Africa project. "Understanding the constraints and incentives affecting adoption is crucial, if innovations are to be relevant for farmers."

The four-year Adoption Pathways project is funded by AIFSC, managed by ACIAR and led by CIMMYT, in collaboration with national universities and research

SIMLESA promotes appropriate maize technologies.

institutes in Ethiopia, Kenya, Malawi, Mozambique and Tanzania; the University of Queensland, Australia; the Norwegian University of Life Sciences; and the International Food Policy Research Institute (IFPRI). According to Menale, the project is closely linked to SIMLESA, working where SIMLESA has been promoting and testing conservation agriculture using demonstrations on farms and on national agriculture research stations.

Farmers learn from their peers, particularly early adopters and those who lend their farms to showcase the practices. Fatuma, a widowed mother of 10 and an early adopter who farms with help from her children, says reducing tillage has cut her work load. She is a role model to other farmers – a rare feat for a woman, according to village sources – and neighbors have decided to try conservation agriculture after seeing Fatuma's crops flourish.

"Project staff members will evaluate the data and use the rich survey information to provide advice on potential policy and technical interventions," said Chilot Yirga, researcher with the Ethiopian Institute of Agriculture Research (EIAR) and country coordinator for the project. Innovative livestock management and community engagement can help, according to Yirga, as can providing alternative cattle feeds such as intercropped legume fodders, which also enrich soils by fixing nitrogen. "The way to show this is through on-farm demonstrations," said Wood, lauding the researchers for the on-station trials and on-farm engagement. "In Australia, conservation agriculture is very important as we must contend with drought and changing rainfall patterns; CA makes us more productive."

Strengthening local innovation platforms in western Kenya

To get SIMLESA technologies widely adopted and promoted in western Kenya, linkages among actors in four newly established local innovation platforms in the region should be strengthened, according to Mulugetta Mekuria, SIMLESA program coordinator. The technologies include use of zero tillage and the associated practice of retaining crop residues, as well as use of cover crops and improved maize and legume varieties. Located in the Bumula, Kanduyi, Liganwa and Karemo areas, the platforms center around SIMLESA trial clusters and were established between December 2012 and February 2013, through the facilitation of scientists from KARI's Kakamega research station who are implementing SIMLESA activities.

Each platform has broad objectives geared toward improving the food security and economic status of nearby farming communities, through environmentally sustainable conservation agricultural practices. Stakeholders representing various organizations and knowledge groups have developed annual action plans through participatory approaches, defining individual roles and responsibilities in scaling out. To ensure their sustainability as organizations, they have identified the resources required and approaches for securing them, which include stakeholder contributions and donations, as well as developing proposals for additional funding.

The stakeholders have also drawn up innovation platform bylaws as per their respective constitutions. Monthly planning and review meetings have been held. The local innovation platforms have been officially registered as community-based organizations (CBOs) by government authorities.

The four platforms have set up field demonstration plots on quarter- to half-hectare farms, where different

Smallholder farmers show produce obtained through conservation agriculture.

integrated technologies are showcased by stakeholders. The technology demonstration farms have been used during field days and as a knowledge-sharing forum. For example, the field day of the Karemo innovation platform in Siaya on 28 June 2013 included a field demonstration farm featuring various conservation agriculture technologies and diversified maize and legume cropping systems. Members from different institutions and other participants displayed farm produce, value-added products and livestock. Although the area had been hit by drought during the crop season, maize stands under conservation agriculture were not adversely affected, whereas groundnuts and cowpeas under conventional agriculture practices were seen to be struggling with the drought. The event drew more than 400 participants, including Siaya County government officials, extension staff, KARI scientists, representatives of Karemo innovation platform (KIP) institutions and members of the Bungoma South Farming innovation platform (BUSOFIPs).

SIMLESA pictorial

Admiring a serene green SIMLESA maize field in Ethiopia. Scientific research provides practical solutions to challenges facing this staple food crop.

An innovation platform meeting in Ethiopia. Among other things, these platforms promote community cohesiveness.

Dr. Fred Kanampiu addresses the Hon. Felix Koskei, Cabinet Secretary for Kenya's Ministry of Agriculture, Livestock and Fisheries (in suit and tie), and other dignitaries who visited a SIMLESA Kenya site.

Dr. B.M. Prasanna, Director of CIMMYT's Global Maize Program (with microphone), and Mulugetta Mekuria, SIMLESA program coordinator, welcoming CIMMYT's Board of Trustees to the SIMLESA booth at Kiboko Field Day held on 25 September 2013.

Julius Owako, a farmer in Kenya's Siaya County, checks his legumes. A member of the local SIMLESA innovation platform, Owako practices conservation agriculture.

SIMLESA members and partners during a field visit to Siaya County in Kenya.

Dr. John Dixon, Regional Research Manager with the Australia Centre for International Agricultural Research (ACIAR), talks to SIMLESA Ethiopia Coordinator, Dr. Mekonnen Sime, in Ethiopia.

SIMLESA-Mozambique extension officers empowered with gender integration tools

Participants at the Mozambique gender-mainstreaming workshops are engrossed in a discussion.

To increase equity and women's participation in SIMLESA activities in Mozambique, a two-day training workshop for extensionists and farmers was held in Chimoio, Mozambique, from 12 to 13 August 2013. The gender-mainstreaming workshop provided tools for integrating gender-aware extension activities and to reach vulnerable groups, particularly women and youth. The training is an extension of gender-mainstreaming courses of the Association for Strengthening Agricultural Research in Eastern and Central Africa (ASARECA) that are attended by agronomists as part of SIMLESA's program to integrate gender-sensitive approaches in its activities.

Attended by 28 participants – mainly from public extension services and development agencies of Manica and Sofala Districts – the workshop used a variety of methodologies, including group discussion, role-playing, videos and case studies. Although some participants were aware of gender and related issues, for many the concept was not well understood and was challenging to integrate in daily activities. For example, some were not aware of the inequality in traditional ways of selecting farmers for demonstration trials. Thus, the workshop furnished an important introduction to appropriate tools for integrating gender-awareness in all field activities.

Topics included the concept of gender, gender analysis and integrating gender in value chain analysis. Participants recognized the importance of gender tools and the knowledge they acquired to address their own limitations, effectively implementing gender analysis to identify gaps and constraints for women's participation in farming. Moreover, they now know how to contribute to women's livelihoods and ensure equity and equality in their activities.

As part of the workshop, participants elaborated and presented an action plan to implement gender-based approaches, with specific targets for the 2013-14 cropping season. "This was an important step to foster better participation by men and women and to therefore benefit all equally from SIMLESA," said Mulugetta Mekuria, SIMLESA program coordinator. Of particular interest was the knowledge and uptake of new technologies that increase productivity and reduce risks, key objectives of sustainable intensification activities in Mozambique.

SIMLESA innovation platform and field visit in the Southern Region of Ethiopia

To facilitate the adoption of conservation agriculture-based maize-legume cropping systems and associated technologies, a one-day workshop was co-organized by Hawassa Research Center of the South Agricultural Research Institute (SARI) and the Wondo-Genet Research Center of the Ethiopian Agricultural Research Institute (EIAR) on 13 August 2013. The two centers are implementing SIMLESA program activities in five districts of the Southern Region of Ethiopia.

Workshop participants included key stakeholders and regional innovation platform members from the South Bureau of Agriculture, the Bureau of Natural Resources and Environmental Protection, the Zonal Department of Agriculture, the District Offices of Agriculture, the District Administration, the South Seed Enterprise, DuPont Pioneer Seed Company, the Food and Agriculture Organization (FAO) of the United Nations, non-governmental organizations, SARI and EIAR. CIMMYT's Ethiopia office was represented by Dagne Wegary.

The meeting was opened by Ato Germame Garuma, deputy head of the Southern Region Bureau of Agriculture and head of the Crops Technology Extension Directorate of the Southern Regional State. After the official opening, a series of relevant technical presentations covered the principles, practices and challenges of conservation agriculture, SIMLESA achievements and experiences in Southern Ethiopia, the innovation systems approach and the roles and responsibilities of innovation platform members.

The workshop was not entirely about presentations. Participants later visited long-term conservation agriculture-based agronomy trials, where they saw SIMLESA selection activities conducted by the Hawassa and Wondo-Genet Research Centers for maize and common bean varieties. The field visit enabled participants to better understand the benefits of conservation agriculture for soil and water conservation and improving soil fertility, as well as to observe the potential productivity of maize and legume varieties being promoted by SIMLESA.

A SIMLESA innovation platform and field visit to southern Ethiopia.

Finally, several challenges to the adoption of conservation agriculture were raised and thoroughly discussed. Stakeholders appreciated the innovation platform, which brought together all relevant stakeholders, and agreed to undertake all responsibilities given them to accelerate the promotion and adoption of sustainable maize-legume cropping systems.

SIMLESA present at China International Farming Symposium

Legumes are a key focus of SIMLESA's activities, as seen during this field visit to a site in Ethiopia. SIMLESA activities in Africa were highlighted.

More than 70 papers on systems research were presented at the 4th International Farming Systems Design Symposium in Lanzhou, China, from 19 to 22 August 2013, including a presentation on SIMLESA. CIMMYT researchers were represented by Bruno Gérard, director of the Conservation Agriculture Program, and agronomists Santiago López-Ridaura, Jack McHugh, Isaiah Nyagumbo and Tek Sakpota. The event was organized by the Gansu Academy of Agricultural Sciences, a partner in the WHEAT CGIAR Research Program, and others.

Research with a farming systems perspective can have various objectives, ranging from increasing knowledge about farming systems to solving specific farming system problems. If it is commonly agreed that cross-links between disciplines and participatory approaches are needed to provide solutions, "there is no silver bullet approach to be expected," said keynote speaker David Norman, professor emeritus of agricultural economics at Kansas State University and a pioneer in Farming Systems Research (FSR). "The most important thing is to take into account the whole farming system and bring together all stakeholders," Norman explained. "If a project works on one crop, like CIMMYT on maize for instance, FSR would look at maize impacted livestock components, etc. The reductionist approach would look at how improving productivity of one item without considering the whole farming system."

Peter Carberry, chair of the Program Committee and deputy director at the Commonwealth Scientific and Industrial Research Organization (CSIRO), stated, "This conference is about bringing together those who are interested in more integrative science and having all disciplines articulating possibilities for the future in terms of agriculture and farming." One benefit of the conference for him was that, among the 300 participants, there were 200 Chinese researchers and students, some of whom may not have been exposed to this thinking before. "We have a mix of people who are familiar with farming systems design and others who are just starting to learn about it; it is a great opportunity," Carberry said.

Ling Ling Li, professor at Gansu Agricultural University and a keynote speaker, shared a similar point of view.

"This platform is a really good start for all experts and students involved in farming systems design, as we do not yet have many scientists doing this type of research in China."

During the first two days there were several presentations on Africa and on the SIMLESA program led and mentored by CIMMYT. "SIMLESA has been innovating in so many different ways," said John Dixon, senior advisor in ACIAR and principal regional coordinator for Africa, "Firstly about systems and farming systems, participatory approaches and new experiments in research methodologies targeting not only productivity but also reduced risks, because for farmers risks are sometimes more important than total yields."

Important questions included how to improve participation with farmers, how to get the private sector involved in marketing through innovation platforms, how to manage risks and how scientists can work much better at systems productivity to understand better nutrition "to better feed our future farmers," Dixon insisted. On the last day, a special session brought together Australian and Chinese farmers to discuss farming operations. This opportunity to exchange information and share experiences on climate risks, prices and yields created enthusiasm among all participants.

Planning in Mozambique for scaling out

SIMLESA's annual planning, review and evaluation workshop for scaling out during 2013-14 took place at the Rufaro Conference Centre in Chimoio District from 29 September to 5 October 2013. The main objectives were to evaluate the core activities of 2012-13 and review progress towards reaching the project target of 650,000 farmers by 2020 in the five SIMLESA program countries.

Mulugetta Mekuria, SIMLESA program coordinator, welcomed participants to the meeting and emphasized the importance of fostering partnerships. He said national institutions alone cannot attain desired targets, hence the need for SIMLESA to increase networking. Participants were informed that during the 2012-13 cropping season in both Malawi and Mozambique, maize yields were significantly higher under conservation agriculture than under conventional cropping systems and proper weed management increased yields regardless of the system. Another finding was that recurrent, low legume yields – an average of 0.6 tons per hectare (t/ha) in both countries – can be raised through early planting combined with the use of pesticides. During 2012-13 in both countries, SIMLESA partners developed household typologies and a value chain analysis and conducted baseline surveys. It was reported that at least 71 percent of farmers in the SIMLESA communities used mulch and 15 percent of the farmers in the areas bordering SIMLESA communities had adopted at least one SIMLESA technology. Adoption had been constrained in Mozambique by inefficient maize and legume value chains, high input costs and lack of access to technologies or credit and in Malawi due to lack of money.

In Malawi, maize varieties under evaluation from the national research service and CIMMYT-Zimbabwe were preferred by farmers for their high yields, disease tolerance and early maturity. Based on similar qualities, several legume varieties were selected during the 2012-13 season. In evaluation trials in the Vanduzi area in Mozambique, partners obtained high yields for soybeans (2.75 t/ha) and cowpeas (1.75 t/ha). In the mother trials with optimal levels of fertilizer, Pristine 1 had the greatest yields (at least 5 t/ha in the Messambuzai area), due to variety and environmental effects, with similar results in the other mother and baby trials. Discussions were held on identifying of new varieties and increased seed production through better partnerships. Scaling-out could increase during the 2013-14 season in Malawi and Mozambique. The six innovation platforms established in six communities taking part in SIMLESA in Malawi and Mozambique played a pivotal role in the dissemination of information on SIMLESA technologies, through farmer exchange visits, demonstration trials, follower farmers and field days.

Participants learned that innovation platforms in Ethiopia, Kenya and Tanzania had improved farmers' access to inputs, resulted in rigorous scaling-out strategies and reduced obstacles in maize-legume value chains. In Malawi and Mozambique, innovation platforms needed strengthening. In both countries, output markets are characterized by unclear and fluctuating prices, little value addition, low legume volumes and poor group marketing. It was observed that marketing can be improved through value addition, use of improved maize and legume varieties, farmer organization for increased group bargaining and the use of information and communications technologies such as mobile phone services.

Siaya cluster local innovation platforms in exchange visit to Bungoma South farming innovation platform

As part of a strategy to strengthen local innovation platforms, 20 members of the Karemo and Boro innovation platforms in the SIMLESA Siaya clusters visited the Bungoma South Farming innovation platform-SIMLESA (BUSOFIPs) in October 2013. During the one-day exchange visit, the members of all innovation platforms shared their experiences regarding the challenges associated with forming and strengthening the platforms and opportunities for addressing the challenges.

In a brief meeting at the Bungoma District Commissioner's boardroom, the participants noted similarities in their overall objective of evaluating and scaling-out maize-legume intensification technologies and knowledge under conservation agriculture systems for improved food security. The platform members also resolved to continue strengthening their ties to broaden areas of operation and create larger markets for farm produce.

An innovation platform member from Kenya Seed Company displays improved seed varieties to stakeholders.

The team participated in a field tour of the Kenya Seed Company depot and later to demonstration plots in Bungoma. At the Kenya Seed Company, David Situma showed the visitors maize varieties on demonstration farms under conservation agriculture.

They also visited the farm of Vincent Okumu in Bukembe, Kanduyi Division, Bungoma South District, to see first-hand an integrated farming approach involving crops such as bananas, finger millet, butternuts, onions, cowpeas, maize, sweet potatoes, fertilizer trees, cassava, pineapples, NERICA rice and sorghum, all cultivated under conservation agriculture technologies. A member of BUSOFIPs, Okumu is the leader of a 65-member farmer group comprising mostly widows. The group's bank account contains the equivalent of just over US $90. Okumu said the group receives recommendations from both the Ministry of Agriculture and the innovation platform, which manages a quarter-hectare section of Okumu's farm as a demonstration plot used for field days and exchange visits. The crops grown on the plot generate income, conserve the soil and improve its nutritional balance and fertility.

The impacts of hybrid maize seed on the welfare of farming households in Kenya

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Highlights

- We estimate the impact of hybrid maize seed use on income, assets, poverty and inequality with a four-year panel data set of smallholder maize-growing households in Kenya.
- Use of hybrid seed increases both total household income and the total value of assets.
- Use of hybrid seed reduces inequality and the depth of poverty.
- Impacts of hybrid seed use differ between major and minor maize-growing areas.

Abstract

This paper explores the impacts of hybrid maize adoption on the welfare of farming households in Kenya. We use a four-year panel dataset to estimate the effects of hybrid seed use on four indicators of household welfare – income, assets, inequality and poverty. Results show that use of hybrid seed not only contributes to higher annual income, but also to raising the value of assets, possibly reflecting longer-term welfare effects. Further, we find that use of hybrid seed reduces the depth of poverty, and that the amount planted reduces inequality. As expected, impacts differ between major and minor maize-growing areas of the country. Maize farmers who do not use hybrid seed are clearly disadvantaged. This calls for continued public and private investments in the infrastructure and policy process that supports a competitive, liberalized seed industry and improved access of smallholder farmers to well-adapted, affordable hybrids.

Climate-related risk and investment in soil fertility management

John Dimes and Daniel Rodriguez[1]

Introduction

Smallholder cropping systems in Africa are characterized by chronic low productivity due to a continuing lack of investment in soil fertility management. Fertilizer use in sub-Saharan Africa (SSA) is extremely low, inputs of biological N fixation are limited by ubiquitously poor legume yields (Giller and Cadisch 1995; Giller et al. 2009) and farmyard manure is mostly of low nutrient content (Probert et al. 1995; Probert et al. 2005). While over 90 percent of crop land in SSA is rainfed, Foley et al. (2011, see Figure 3) have shown that the potential for increasing maize yields across the sub-continent is overwhelmingly constrained by nutrient limitations; in their analysis, water was identified as a sole constraint in only southwest Zimbabwe and regions of South Africa. Keating et al. (2010) point out that unless ways are found to relieve the soil fertility constraint in Africa, eco-efficient use of other natural and human resources will remain low.

Increased fertilizer use in Africa's smallholder cropping systems offers the most promise for alleviating recurring farm-level food insecurity and providing the impetus for agricultural production to drive economic growth on the continent (Nature 2012; Gilbert 2012). There are known, reinforcing market-related (poor infrastructure, market development and marketing strategies) and socioeconomic (widespread poverty, poor extension services, lack of incentives) factors contributing to farmers' low investment in fertilizer in Africa (Morris et al. 2007). However, because fertilizer use interacts strongly with crop water supply in determining returns on investment, coupled with its generally high proportion of variable input costs, fertilizer investments are a major production risk in rainfed agriculture. Hence, for Africa's smallholder farmers, promotion of higher investments in fertilizer use must assume farmers' willingness to take on higher production risk (Keating et al. 2010; Carberry et al. 2013). For risk-averse farmers, this is further complicated by a tendency to over-estimate the frequency of drought conditions (Rao et al. 2011), providing a strong dis-incentive to fertilizer investment.

Overcoming farmers' risk-aversion and risk perceptions is a major challenge for research and development, since risk management is the outcome of highly individualistic attitudes and circumstances feeding into decision making. Getting close to the biophysical environment of farmers is perhaps the best we could expect to achieve. One option for engaging farmers directly on risk analysis and management is participatory modeling, whereby local soil, climate and farmer management is used in conjunction with a cropping systems model to explore alternative management options under variable rainfall conditions (Whitbread et al. 2010; Carberry et al. 2004). Here we describe the experiences of a participatory modeling exercise at a village in eastern Tanzania as part of the Sustainable Intensification of Maize-Legume based Cropping Systems for Food Security in Eastern and Southern Africa (SIMLESA) project (Mekuria et al. 2011).

Farmer perceptions on drought risk

SIMLESA survey results that include the Mandela region discussed below show that 50 percent of farmers rated 30 percent of seasons as drought affected (Figure 1) and 80 percent of farmers indicated that the impact of these droughts on crop yield is severe (data not shown).

A 30 percent incidence of crop failure at Mandela is not evident in the farmers' yields in Figure 4 below, while the simulated yields in Figure 6 suggest that the probability is less than 10 percent. Hence there is evidence that farmers overestimate the frequency of unfavorable seasons.

An example of engaging farmers on climate risk

The SIMLESA project conducted a 3-day participatory modeling workshop at Mandela village, Tanzania, in November 2011. On day 1 of the workshop, the farmer group (10 men and 10 women) was visited for the first time. Half of the farmer group completed a questionnaire on maize yields across seasons. Four farmers provided yield estimates going back 13 seasons, and seven farmers

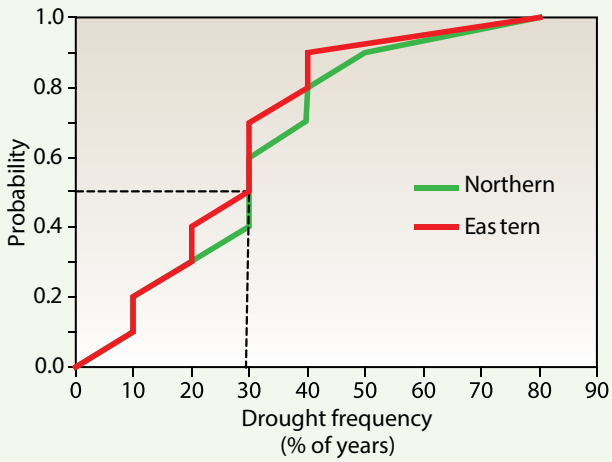

Figure 1. Probability distribution of farmer responses on drought frequency affecting crop production in northern and eastern regions of Tanzania. (Source: SIMLESA Baseline survey, eastern sample area includes Mandela village).

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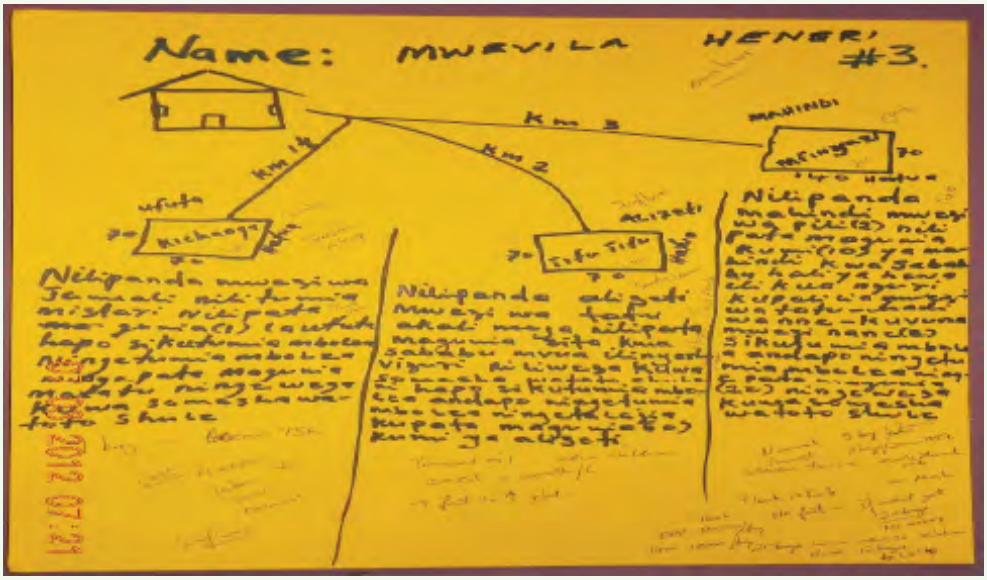

Figure 2. Farmer resource allocation map at Mandela.

provided estimates going back 5 seasons. The other 10 farmers and local extension officers participated in constructing resource allocation maps (RAMs) describing farmer field soils, management practices (sowing dates, variety, row spacing, fertilizer use and weeding dates) and yields in the 2011 cropping season (Figure 2).

Day 2 activities were conducted without farmers. Survey data were entered and yield data analyzed for water use efficiency. The APSIM cropping systems model (Keating et al. 2010) was used to simulate maize yields for 1999-2011 at Mandela. Historical climate data from Ilonga Research Station (approximately 50 km distant) and representative farmer management and soil descriptions were inputs to the model. Farmer management applied in 2011 to a maize field from one of the RAMs was also simulated (Figure 2). The model was calibrated to the farmer's 2011 yields and his 2011 management was extrapolated across previous seasonal rainfall conditions back to 1999.

On day 3, the farmer group was re-visited to share analysis results. Simulated yield outputs for the RAMs' exercise were used with the farmer group to explore management changes in relation to fertilizer use, weeding frequency and interactions with seasonal rainfall.

Farmers in Mandela village did not use fertilizer on maize or on cash crops (sunflower and sesame) and struggled to do more than 1 weeding during the season. They also used mostly recycled seed. Historical rainfall data for Ilonga (Figure 3) was shared with the farmers and its variability explored through farmer interactions with the data, leading to the general agreement that Ilonga provided an appropriate representation of the Mandela climate. The rainfall data showed 1 season in 13 as drought affected (Figure3; < 400mm in-crop rainfall), compared to farmer survey results (Figure 1).

The simulated yield outputs for 1999-2011 reproduced fairly closely the distribution of yields reported by the farmers at Mandela (Figure 4, data not presented to farmers). For the RAM's scenario shared with the farmer group (i.e., Mr Mwevila Heneri, Figure 5.), simulated maize yield was very close to the farmer's yield in 2011 (it having

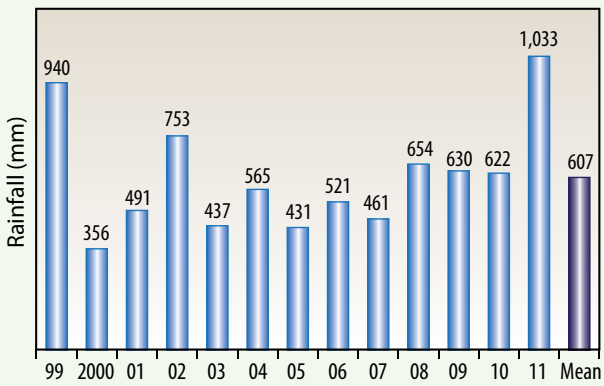

Figure 3. Seasonal (Feb-Jun) rainfall totals at Ilonga Research Station, 50 km from Mandela village.

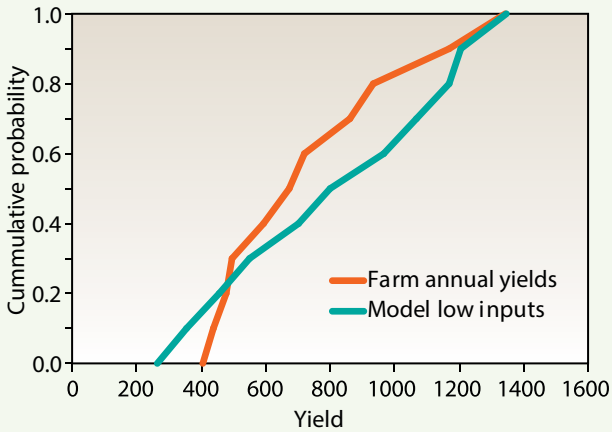

Figure 4. Maize yield distributions (kg/ha) derived from farmer survey data and simulated yields using APSIM for the period 1999 to 2011 at Mandela village, Eastern Tanzania.

been provided in RAMs and used for model calibration) and his average for the field across years (solicited during the discussion, see asterisks in Figure 5.).

However, simulated yields were not close in all seasons discussed with the farmer, in particular his drought-affected yields in 1999. The discrepancies between model and farmer yields provided for discussion on reasons for the differences. The model results for alternative management practices were then shared with the farmers. With fertilizer (50 kg urea /ha), maize yields across seasons were 140 percent higher than under farmer practices and highly reliable. With one weeding, simulated maize yield was 0 in 4 seasons and 75 percent lower than the farmer practice across seasons.

Advantages/disadvantages of participatory modeling

The main benefit of participatory modeling is that it provides yield responses for farmers' own soil and management conditions interacting with local rainfall patterns. Such context-relevant information on climate related risk and returns can give farmers more confidence to experiment with new technologies and improve their crop management. The rapid feedback of information to the farmers only two days after the initial interaction was also much appreciated by farmers and extension officers.

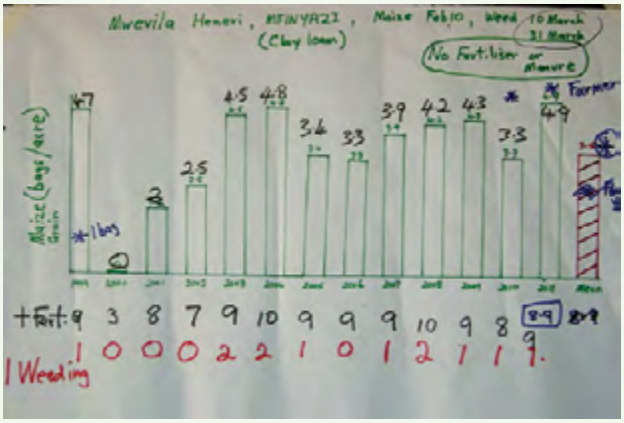

Figure 5. Simulated maize grain yield (bags x 100 kg /acre) for a farmer's field and management (described at top of sheet) at Mandela (bar chart). Yield outcomes for alternative management (50 kg urea/ha, 1 weeding in crop) are shown at the bottom of the sheet (bags/acre).

A further benefit is that, based on the results of the modeling outputs, farmers can be canvassed on possible treatments for on-farm experimentation. In the case of Mandela, an on-farm fertilizer trial was established on two soils where farmers were shown how to apply urea to maize crops and yield responses were tested (four levels of urea applied). A small quantity of fertilizer (2 kg urea) was also distributed to farmers and its use (amount applied, which crop) monitored. The main reason for not using fertilizer in the village seemed to be concerns about the longer term effects on soil health; others included high cost and no experience in using fertilizer. As a consequence, a special feature of the trial design was that residual effects would be tested in the 3rd season, using a test crop nominated by the farmers.

While a 3-day interaction with farmers to develop an experimental program is expensive (and no evaluation of the cost-benefits have been undertaken), the quality of the interaction and relevance of the on-farm trial design to be implemented would seem to justify the high costs of the exercise. The other drawbacks of the approach are the data input requirements, especially local climate data, and the need for high level modeling skills.

Comparison of rainfall risk across sites

APSIM was used to explore the maize grain response to N fertilizer inputs under the same management, soil and seasonal conditions at Mandela and at the more water limited environment of southwestern Zimbabwe (Matopos, near Bulawayo).

At Mandela, the yield distribution for 0 N (the default farmer practice) is very steep, ranging from 300 to 1,400 kg/ha, and is indicative of a very 'resilient', low productivity and low risk cropping system (Figure 6a). With increasing N inputs, there is an almost parallel shift to the right in the yield distributions, except for the least

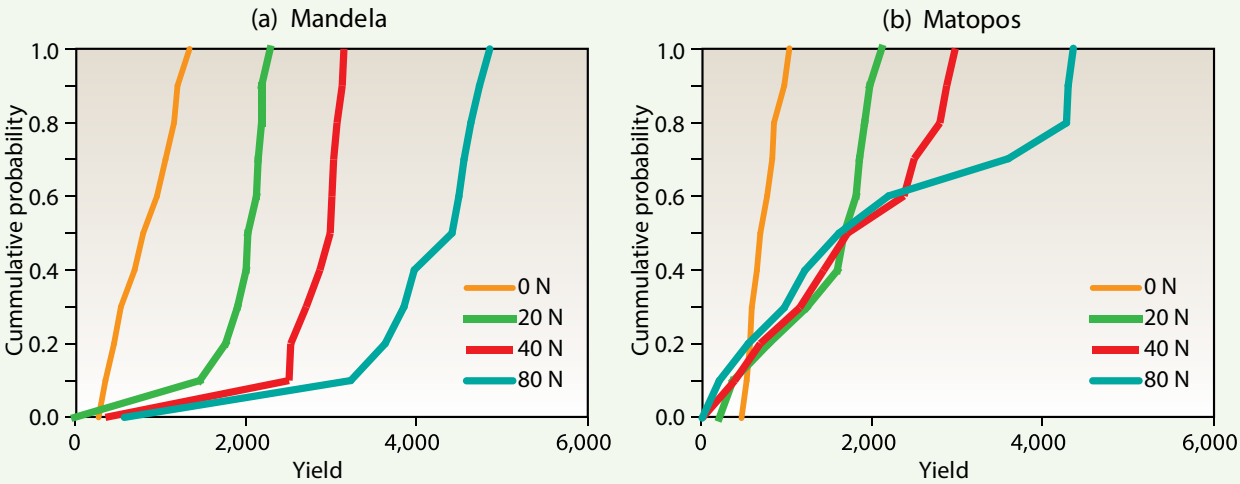

Figure 6. Simulated maize yield distributions (kg/ha) in response to fertilizer N inputs (kg N /ha) at (a) Mandela, Tanzania, and (b) Matopos, Zimbabwe.

favorable 10 percent of growing seasons. This result indicates that fertilizer use in this environment would be a low risk intensification strategy.

At Matopos, the range of maize yields in the 0 N distribution is even tighter than at Mandela (450 to 1,000 kg/ha), but response to N inputs is much more uncertain, reflecting the strong interaction with the more variable rainfall patterns (Figure 6b). Relative to the farmer baseline, high inputs of N (the local recommended level is 60 kg N/ha) can be expected to have negative effects on yield in about 20 percent of seasons, whereas maize yields of over 4,000 kg/ha are achievable in the most favorable 20 percent. On the other hand, the simulated yield distribution for the 20 N treatment suggests that there is an N constraint in the cropping system in more than 85 percent of seasons, rather than a water constraint. Using the 50 percent yield increase criteria of Foley et al., the simulation results suggest that the nutrient constraint is prevalent in 65 percent of the seasons.

Conclusion

To reduce their perception of climate risk as a barrier to increasing investments, farmers and other stakeholders in the agricultural development arena need to be engaged directly on their subjective assessments of climate risk and comparisons made with more objective assessments (rainfall records, crop simulation outputs). This can lead to the design of field experimentation that reinforces the opportunity for changing practices and ultimately increases farmers' investments in crop management technologies.

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About us

This bulletin is a quarterly publication of the Sustainable Intensification of Maize-Legume based Cropping Systems for Food Security in Eastern and Southern Africa (SIMLESA) Program, funded by Australian Centre for International Agricultural Research (ACIAR), and managed by the International Maize and Wheat Improvement Centre (CIMMYT). It is implemented by the National Agricultural Research Systems (NARS) of Ethiopia, Kenya, Malawi, Mozambique and Tanzania in collaboration with the Association for Strengthening Agricultural Research in Eastern and Central Africa (ASARECA), the International Crops Research Institute for Semi-Arid Tropics (ICRISAT), the Agricultural Research Council of South Africa (ARC), the Queensland Alliance for Agriculture and Food Innovation (QAAFI) in association with Queensland Department of Employment, Economic Development and Innovation (QDEEDI) Queensland, and Murdoch University in Western Australia. SIMLESA aims to improve the livelihoods of smallholder farmers in drought-prone areas of Eastern and Southern Africa, through intensification of maize-legume cropping systems.

SIMLESA focuses on five countries in Africa – Ethiopia, Kenya, Malawi, Mozambique and Tanzania (with spillovers anticipated in neighboring countries) – and Australia. The sustainable intensification of maize-legume cropping systems, while reducing yield variability, requires an integrated approach to the complex production and marketing system for these crops. Through participatory research and development with farmers, extension agencies, non-governmental organizations, universities and agribusinesses along the value chains, the program aims to improve maize and legume productivity by 30 percent and to reduce the expected downside yield risk by 3 percent on approximately 500,000 farms within 10 years.

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