

## Facts & Figures

- Huge yield gaps exist between on-station and on-farm productivity. In Ethiopia on station yield potential is 3 t/ha for bush beans compared to 1.5 t/ha on-farm. The average yield potential of climbing beans on station in Rwanda is 4 t/ha compared to 1.3 t/ha on-farm.
- Farmers cannot legally sell their produce across borders because they are unable to meet strict certification guidelines.
- Certification is necessary, but conflicts with farmer interests, particularly in countries where seed companies have no interest in legume seeds.
- Formal seed systems provide new and improved varieties of certified seeds of consistent quality, and relatively high purity. This system is regulated by governments and industry. The system supplies on average 3-20% of all seeds used in production, but is limited to only a few selected crops, e.g., maize, which accounts for 70% of all certified seeds used in Kenya.

# SEEDS OF HOPE

## Unlocking legume seed production in Africa

### Key fact

Legumes account for up to 25% of crop production in smallholder systems, and are an important source of livelihoods and incomes. Production of legume seeds, which are open pollinated, does not attract meaningful commercial investments due to difficulties in recovering production costs.

### Summary

Adoption of legumes is often hampered by poor seed supply. Majority of smallholders obtain legume seed from open grain markets or by recycling the previous year's harvests. Smallholders produce their own seed because private sector involvement in legume seed markets is underdeveloped. Farmers and community-based organizations multiply and sell small quantities of quality declared seed of improved varieties to other farmers within a restricted zone, with minimal formal quality control. Often, the initial seed originates from the formal seed system.

### Background

Legume crops are important components in African farming systems. In addition to providing dietary foods, they provide cash income to smallholder farmers.

Legumes also improve soil fertility through nitrogen fixation. Major legume crops include cowpeas, field beans, soybeans, pigeon peas and groundnuts. These crops are important in eastern and southern Africa, but their production is limited by low adoption of the new and more productive varieties.

Legumes are generally produced in informal semi-structured seed systems involving individuals or communities offering relatively cheaper and readily available seed. This system constitutes about 60-80% of the total seeds used, but lacks support in knowledge, skills and incentives for quality control and hence is not attractive to private sector investors.

### What agricultural policy can do

Recognize and integrate the informal seed system as it is being transformed to a more formal system. Seed system actors should be trained to improve the quality of seeds they produce.

Quality declared seed for crops that are not adequately covered under the formal system should be recognized where applicable. This can be through delegation of quality assurance among seed inspectorate agencies, seed companies, NGOs, research or government enterprises.

Encourage private sector investment in the seed sector. Governments should provide institutional support to develop new and improved varieties; provide quality assurance; upgrade laboratory and market infrastructure; enforce regulations and contracts; and simplify procedures.

The apex national research organizations, public universities, international centres and seed companies

should take charge of variety testing and development because they have the capacity, human resources, skills, physical facilities and access to international genetic resources of many crops.

Seed multiplication should be left to seed companies, small independent producers or those contracted by seed companies, who can meet the stringent, mandatory requirements legislated for the production of certified seed.

Countries should implement the harmonized regional seed regulations in the ASARECA, the Common Market for East and Southern Africa (COMESA) and the East African Community (EAC) regions to speed up cross-border seed movement across common borders. For example, member countries should take advantage of multiple releases to increase access to quality bean seed by farmers through the cross-border seed business.

Seed entrepreneurs should carry out market research on locally preferred genotypes, popularize preferred varieties and train farmers on their agronomy and post-harvest management.

National Agricultural Research Systems should support variety development, production of breeder/foundation seed and provide information on new varieties, support seed production enhancement, and finance variety maintenance activities.

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### ACIAR's contribution to research

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## Facts & Figures

- Evidence from Zimbabwe shows that delayed planting of maize beyond the optimum planting dates as a result of labour bottlenecks reduced yields by 32% while early planting accompanied by the use of herbicides and ripping techniques, increased yields by 72%.
- It is estimated that farmers lose 5% of the total yields for every week delayed in planting.
- Use of herbicides: reduces drudgery in crop production making farming more attractive to the youths who shun farming; and shifts gender roles from women and children to men who do most of the herbicide spraying thereby allowing women to divert their labour to other activities.

# BYE-BYE HAND HOE

## Access to herbicides changing smallholder farmers' fortunes

### Key fact

- Hoe weeding in smallholder cropping systems in Eastern and Southern Africa accounts for 75% of the labour input in crop production.
- Use of herbicides can alleviate labour bottlenecks encountered by farmers during planting and the critical 2-3 week period after planting.
- Use of herbicides is limited by inadequate access, inappropriate packaging and adulteration.

### Summary

The use of herbicides in conservation agriculture reduces labour required for land preparation and improves timely planting of crops at the onset of the rains. Use of herbicides alone increased yields by 30–133% in Malawi and saved labour by 20–35% equivalent to 19 person days per hectare. Similar yield benefits were also observed in Tanzania.

Currently the use of herbicides in eastern and southern Africa is very low. Based on consumption data for the period 1990 to 2013, Kenya, Zimbabwe and Ethiopia are the highest consumers at 8, 12 and 14% respectively.

### Background

Conservation agriculture is a sustainable intensification technology premised on minimum soil disturbance, provision of permanent soil cover and the use of crop rotations. Conservation agriculture provides farmers with a strategy for saving labour, reducing erosion-induced soil degradation and mitigating against long dry-spells.

However, initial high weed infestations usually caused by switching to conservation agriculture and the drudgery associated with manual weeding pose serious challenges for farmers.

Bye-bye hand hoe: Access to herbicides changing smallholder farmers' fortunes

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Herbicide use in SIMLESA sites in the five countries increased over the three year period, 2010 to 2013. The highest users were Ethiopia and Kenya at 43% and 52% respectively (Figure 1).

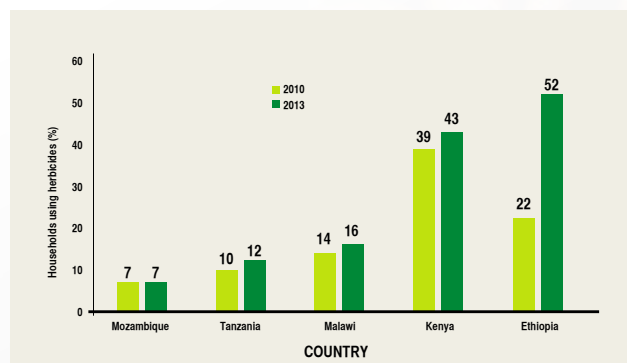
The increases were influenced by farmer training and ease of access. In Malawi, farmers perceive labour savings as the most important benefit they derive from using conservation agriculture. Prior studies showed that the use of herbicides among farmers practicing conservation agriculture rose from 12% in 2004/2005 to 97% by 2009/2010 when farmers accessed credit. The credit was used to buy herbicides.

The benefits of using herbicides can only be realized if farmers can access the herbicides easily and at affordable costs. Over 90% of the farmers using conservation agriculture in Malawi point to high cost as one of the main impediments to use of herbicides.

### What agricultural policy can do

Ministries of Agriculture and institutions tasked with the regulation of importation and distribution of herbicides should simplify approval for importation and marketing of herbicides in the region. They should also regulate the packaging of herbicides to quantities required by

**Figure 1. Percentage households using herbicides between 2010 and 2013 in SIMLESA project sites.**



Source: Menale, 2013.

smallholder farmers and control proliferation of non-standard products.

Governments and extension services providers should train farmers and agro-dealers on the safe use and handling of herbicides to increase efficiency, clear the myths and misconceptions about herbicides; and facilitate the setting up of technical service spraying units.

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## Facts & Figures

- Efforts at facilitating regional trade expansion through implementation of the Customs Union and the Common Market protocols, one-border posts and single-customs territory have begun to yield results for EAC Partner States.
- Rwanda is now the third most competitive country in Africa according to World Economic Forum Global Competitiveness Index
- Gatuna Border between Rwanda and Uganda now operates 24 hours a day, seven days a week, while the Rusumo border with Tanzania and the Cyanika and Kagitumba borders with Uganda now operate 16 hours a day, seven days a week.
- Implementation of the single customs territory has reduced transport days from 21 to 5 days from Mombasa to Kigali and the cost of hiring a truck to transport cargo from Mombasa to Kigali has been reduced to US\$ 4,200 in 2014 from US\$ 5,200 in 2010<sup>6</sup>.
- Earlier efforts in deregulation and privatization of the trucking industry in Rwanda in the early 1990s reduced transportation costs by 90%.

# KNOCKING DOWN BARRIERS

## Intra-Africa trade, the ray of hope for agriculture, employment

### Key fact

- Intra-Africa trade is the lowest globally amounting to only 10-20%, compared to South America at 26%, North America at 50%, East Asia at 52% and EU at 70%.
- Intra-Africa trade in agricultural goods and services stands at 34%, 42% between SADC countries, 20% between COMESA countries and 6% among ECOWAS states.

### Summary

Facilitating intra-Africa trade expansion has high potential to spur entrepreneurship in agriculture towards youth employment and value addition in the regional economy. However, a seamless flow of trade is constrained by over-regulation, high transfer costs and limited product diversification.

The answers lie in better trade facilitation towards improving the soft and hard infrastructure for regional trade. This encompasses improving road infrastructure along key corridors, upgrading customs infrastructure, processes and management systems, elimination of non-tariff barriers, development and use of quality standards, and harmonization of trade facilitating policies.

### Background

Expansion of regional trade enhances the capacity of African countries to raise their competitiveness and benefit from rising demand in regional markets. Regional trade also provides the experience needed to break into global value chains and trade. Intra-Africa trade in agrofood products is projected to more than double between 2013 and 2030 due to rising demand even without any trade reform in Africa. Over the period 1989 - 2007, only 13% of African exports went to Africa while 64% went to Europe and 23% went to Asia<sup>2</sup>.

### What agricultural policy can do

**Lowering transportation costs:** Transportation costs in Africa are a larger impediment to trade than tar-

Knocking down barriers: Intra-Africa trade, the ray of hope for agriculture, employment

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iffs and other trade restrictions. The cost of transportation in Sub-Saharan Africa in 2009 ranged from \$0.06 to \$0.11 per ton-kilometer, compared to \$0.04-0.05 in Brazil, China, United States, and Western Europe<sup>1</sup>. The costs are higher for landlocked countries. For example, moving maize from Masindi in Uganda to Bujumbura in Burundi a distance of 1,011 km, takes 3-4 days with transport costs accounting for 32% of total trading costs. The main factors behind the high costs are poor road conditions and delays in crossing borders. Regional and national action is needed to prioritize and implement road infrastructure development and refurbishment and electronic single window customs procedures.

**Removal of non-tariff barriers to trade:** The Tripartite Free Trade Area between COMESA, EAC and SADC established an online non-tariff barriers reporting, monitoring and eliminating mechanism - <http://www.tradebarriers.org/>. This is supported by a time-bound programme for elimination of non-tariff barriers, national focal points and national monitoring committees who meet regularly and report to a regional fora.

By 2014, some 79 non-tariff barriers to EAC trade had been cumulatively resolved while 22 remained unresolved<sup>4</sup>. Member countries are urged to support this mechanism including the use of simplified, harmonized regulations and procedures for permits and approval of business transactions<sup>3</sup>.

**Enhancing access to market information:** Investments are needed in market information systems including ICT, rural internet connectivity and mobile telephony options to raise awareness on prices, trading regulations and related reforms, supply and deficit zones, stock levels, etc.

**Enhancing productivity:** Each dollar invested in agricultural research and development has been estimated to provide returns of up to \$10 or more to the overall economy. Overall public sector expenditure on agriculture in the region still lags behind the Maputo recommendation of at least 10% of the national budget. The average expenditure for EAC countries stands at 4.4%; 3.3% for COMESA countries and 2.7% for SADC countries. This should be met to facilitate innovation and technology generation<sup>2</sup>. Market-smart input subsidies, which are well-targeted to poor farmers, use private sector distribution systems for limited periods of time and with clear exit strategies, are also needed.

**Enhancing value addition and diversification:** Governments should encourage public-private sector partnerships that support value addition and technology incubation. Agribusiness incubation supports the creation of viable, competitive agro-enterprises through technology development and commercialisation. As part of the incubation process, technologies for value addition and products are developed, tested for market feasibility and the enterprise guided through the commercialisation process until it has graduated<sup>5</sup>.

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<sup>4</sup>EAC. 2014. The Status of Eliminating Non-Tariff Barriers to Trade in the East African Community as per December 2014.

<sup>5</sup>Odame, H., Methu, J., Kangai, E., Akishule, D., Owino, W., and Aloit, C. 2014. Opportunities for commercialisation and research under the banana, coffee and sorghum value chains in Kenya and Uganda. ASARECA, Entebbe.

<sup>6</sup>The New Times. 2015. Rwanda reaping benefits as EAC member – Rugwabiza. <http://www.newtimes.co.rw/section/article/2015-04-13/187793/> accessed 15 Sept 2015.

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## Facts & Figures

- Farming systems in Africa are complex requiring a diverse range of actors to interface with farmers within an innovation systems approach
- The ratio of agricultural extension to farmers in eastern and southern Africa is low and still dwindling
- Scope of information provided by extension is predominantly on productivity
- Innovation platforms approach enhances linkages of producers to a range of business and input services and products.
- SIMLESA is facilitating 50 agricultural innovation platforms in participating countries

# PEOPLE POWER

## Harnessing social capital for farmer empowerment

### Key fact

Research evidence from the SIMLESA project sites shows that farmers who operate collectively are more likely to use sustainable intensification practices.

Innovation platforms account for more than 75% of information accessed to enhance adoption among smallholders. They are critical for sustainable and effective scaling up among hard-to-reach populations.

### Summary

Social capital refers to the complementary norms, values, attitudes and beliefs that govern interactions among people and institutions and predispose them to cooperation and mutual assistance leading to a reduction in transaction costs and social learning. Agricultural innovation platforms are one of the ways to build social capital among farmers. Innovation platforms are virtual or physical multi-stakeholder fora that bring together a diverse range of actors along a prioritised value chain to exchange knowledge and take action to harness an opportunity. Innovation platforms enhance social capital by strengthening collective action, networking and learning while reinforcing farmers' capacity to participate actively along the value chain. Through innovation platforms,

partners are empowered to access and generate information that enables informed decision-making and innovation. Establishment of innovation platforms is flexible, iterative and interactive, and roles of partners change over time (Figure 1).

### SIMLESA experiences

Based on SIMLESA's experience, successful agricultural innovation platforms are structured business-focused alliances of institutional actors to enable and sustain mutual benefits. Each of these actors derive clear benefits, based on their critical but unique roles: marketing, credit, investment, new agricultural technologies, reduced input costs, and interact with policy/ decision makers. Their collaboration results in customised solutions that simultaneously address

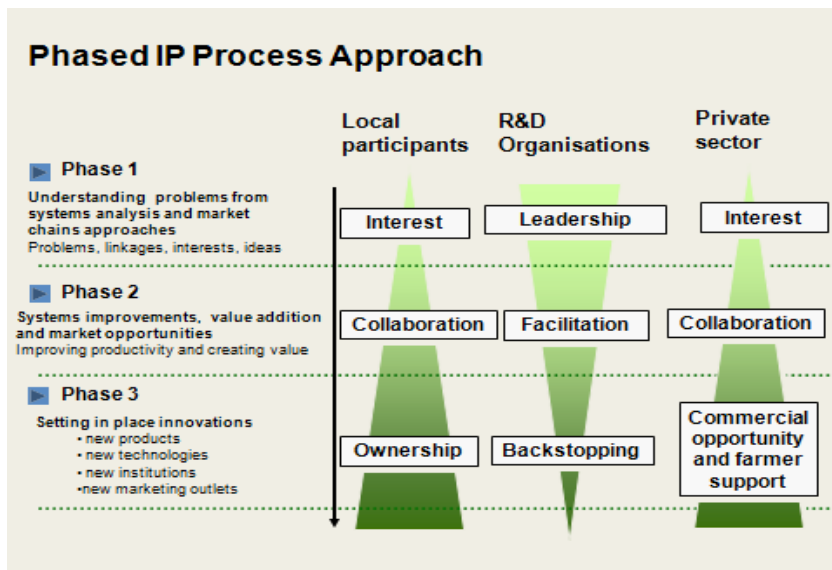


Figure 1. Phase innovation platforms' process approach (Source: Tukahirwa et al 2011)

fundamental farming constraints. For example, Gataraga innovation platform in Rwanda has successfully increased potato supplies to Kigali.

### Strengthening farmer institutions for collective action must ensure that:

Farmer groups are small, with preferably 10-30 members. Small groups

enhance face-to-face interaction, limits coordination and management costs, reduces scope for conflict, facilitate dispute resolution, encourages equitable and active participation of all members.

Management, organizational and business skills that enables farmers harness strategies for upgrading their position in the value chain and meet

market requirements are strengthened.

**What agricultural policy can do**  
Support mainstreaming and up-scaling of collective action using, for example, the innovation platform approach. Central and local governments can enhance wide-scale collective action from the small pockets of success to empower more farmers. This would in part require retooling of extension workers to enhance their capacity for innovation platform facilitation; mainstreaming the innovation platform approach in the budgeting and planning process; strengthening the legal framework for collective action and reviewing the agricultural education curricular to ensure capacity building in innovation platform approaches.

Local and central governments should: provide budgetary support to facilitate formation and operation of innovation platforms at the grassroots; and foster social capital formation for sustainability, for instance, through partnerships with NGOs; and strengthen extension skills through structured mentoring.

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## Facts & Figures

- Hunger and malnutrition are still harsh realities for more than one billion people around the world.
- A growing population that is projected to double by 2050 has to be fed despite declining land and water resources.
- Sustainable agricultural intensification can avoid some pitfalls of the green revolution and generate high productivity and better resource management.
- For many rural households, food security depends on productivity enhancement through improved maize varieties and appropriately targeted sustainable intensification practices as a package.

# TIME TO ACT

## Promoting sustainable intensification in agriculture

### Key fact

Win-win outcomes have been witnessed with adoption of practices that increase yields and also conserve agricultural resources.

Sustainable agricultural intensification practices are knowledge intensive and need strong, consistent and high quality extension services.

Social capital, public goods, and private assets remain critical preconditions for sustainable agricultural intensification.

Time to act: Promoting sustainable intensification in agriculture

**POLICY BRIEF**





## Summary

More food needs to be produced to avert hunger due to increasing populations in Eastern and Southern Africa. The challenge of feeding growing human populations comes at a time of unprecedented global challenges including climate change, dwindling water and land resources, shifts in consumption patterns that are putting unprecedented pressures on agricultural resources.

Two critical choices have to be made: either increase food production by bringing more land into agriculture or find ways of increasing yields on existing agricultural land while protecting the natural resource base and environmental services.

The first choice presents a course of least resistance but is fraught with many bottlenecks because supply of land is finite. Moreover fragile ecosystems and biodiversity need to be protected, imposing a tight constraint on new cultivable land. The second choice is the most viable option and calls for 'sustainable intensification' of agriculture. This option increases crop yields without exerting negative environmental impacts and without expanding the agricultural frontier.

## Background

Sustainable agricultural intensification requires adoption of production practices that enhance crop yields and contribute to reducing the environmental risks to crop production. These practices include soil-conserving tillage methods, crop diversification and stress

tolerant but high yielding crop varieties, use of fertilizers and investments in soil and water resources management.

Although the benefits may be obvious, sustainable agricultural intensification requires a major policy rethink. Part of this rethink involves investments in natural resources management in agriculture and high standards of agronomy.

Practices such as water and soil conservation and integrated soil fertility management are integral to sustainable intensification. This should then be accompanied by concomitant and strong investments in fertilizer and seed supply chains.

## What agricultural policy can do

Research under SIMLESA and other projects has shown that the best outcomes in terms of income were related to simultaneous adoption of sustainable agricultural intensification practices. The following are a summary of policy highlights that have emerged from SIMLESA research:

**Increase frequency and access to extension information:** Sustainable agricultural intensification practices are knowledge intensive: strong, consistent and high quality extension services are a must. Some experts have suggested 33 frontline extension workers for every 10,000 farmers to be a minimum required for an effective extension system.

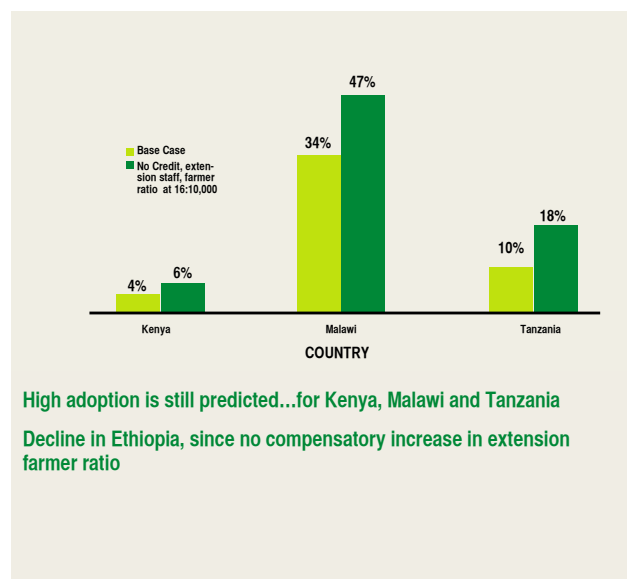
Research evidence generated under SIMLESA shows that availability of extension services produce some of the strongest effects in predicting the adoption of better agronomic practices (Figure 1). Policy attention from governments should therefore, focus on increasing the frequency and the amount of information available to farmers to enhance adoption of sustainable agricultural intensification practices. Governments can support the institutional and human capacity of a diverse set of actors to provide extension services.

**Improve market access, lower costs of inputs and make inclusive finance available:** High cost of inputs is a deterrent to the adoption of good agricultural practices and technologies.

SIMLESA research has shown that input subsidies have powerful effects in predicting adoption of sustainable intensification agricultural practices. Setting input subsidy expenditures at levels comparable to those recently observed in Malawi, increased adoption by more than 100% in Ethiopia and Kenya, and by about 70% in Tanzania (Figure 2). The powerful effect of subsidies is a result of their cost-reducing nature.

**The basic premise behind this is as follows:** reducing cost of inputs across the board is paramount for agricultural progress. Therefore, in terms of sustainable options for improving farmers' access to inputs,

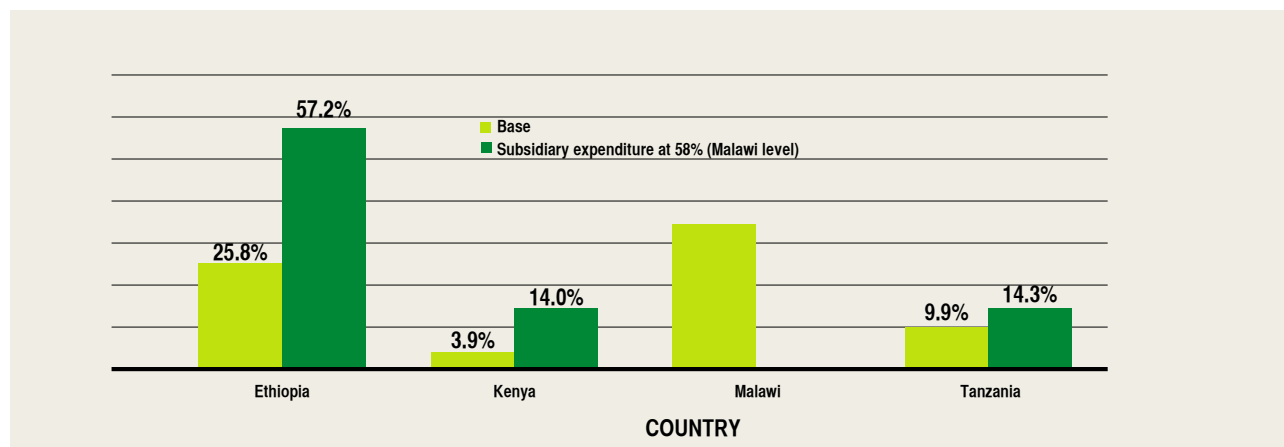
**Figure 1. Effects of increasing extension personnel on adoption of conservation tillage.**



the following principles should be considered. In the short term, to increase the reach and targeting of much needed micro-finance to farmers, the use of innovative mobile money platforms should be considered. In the medium term, governments should target delivery of smart subsidies for inputs.

These can be based on selection mechanisms such as verifiable adoption of resource improving practices that require only family labour. In the long run, efficient input supply chains built on sound infrastructure provides one of the most durable solutions. Related to subsidy policies is the role of safety nets in agricultural development. Available research information shows that perceived support from government provides

**Figure 2. Impact of high subsidy expenditures on adoption of sustainable intensification practices**



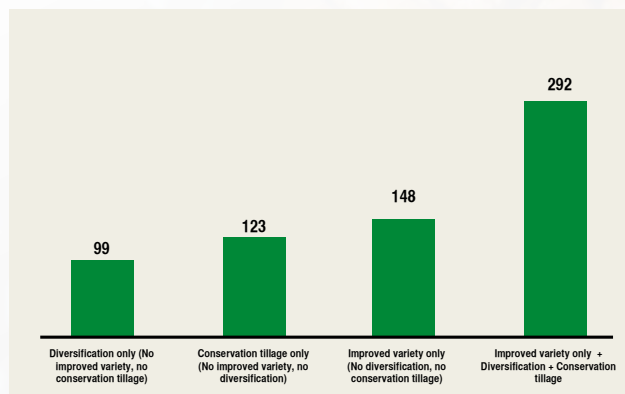
some assurance to farmers to try new technologies. This means that providing safety nets can help build farmers' confidence to try new crop varieties and agricultural practices.

**Support integrated approaches to technology development and dissemination:** Research under SIMLESA and related projects has shown that the best outcomes in terms of crop income were related to simultaneous adoption of combinations of recommended practices. In the example shown in Figure 3 it is apparent that crop incomes are more than twice in Ethiopia when combinations of practices are adopted compared to when only one practice is present.

The lesson is that promotion of better agronomic practices and crop varieties should be done as packages in adaptive research, extension messaging, policy support and public investments. In each case, specific

packages suitable for particular locations and groups of farmers should be researched, disseminated and supported.

**Figure 3. Adoption of sustainable practices in Ethiopia: impacts on income (\$/ha)**



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## Facts & Figures

- Sub-Saharan Africa croplands lose 30 to 80 kg per hectare of essential plant nutrients like phosphorous and nitrogen annually.
- Soil nutrient depletion is a major cause of low crop productivity and malnutrition in Sub-Saharan Africa
- Africa accounts for less than 3% of the global fertilizer market demand
- To meet the NEPAD target of 6 percent annual growth in agricultural output, the level of fertilizer use in African agriculture has to be increased to an average of at least 50kg per hectare per year. Only Botswana and South Africa have met this target.
- Low fertilizer use is partly explained by high prices, which are almost double those farmers pay in India, Brazil and China.

# NOURISHING SOILS

## Enhancing fertilizer use in Eastern and Southern Africa

### Key fact

Fertilizer use in Eastern and Southern Africa is extremely low at around 10 kg per hectare against a global average of 100 kg per hectare.

Inherently low soil fertility, coupled with nutrient mining by crops, leaching and soil erosion have resulted in negative nutrient balances averaging about -62kg of nutrients per hectare per year. Of the three essential elements in fertilizers, nitrogen and phosphorus are the most affected.

### Summary

Research has shown high response of crops to fertilizer, especially nitrogen and phosphorus. However, the relatively high cost of fertilizers, combined with low agronomic efficiency, makes the use of fertilizers unprofitable in Sub-Saharan Africa. For example, between 1980 and 2004, the ratio of world nitrogen prices to world crop prices averaged 1 to 4.5. The ratio is generally lower for rice and higher for maize because rice is more expensive than maize in global markets and higher in Africa than elsewhere. The high cost of fertilizer in Africa is driven by many factors including the lack of own manufacturing facilities, storage and blending facilities; poor rural infrastructure; a limited dealer network; small market size; over product differentiation; limited bulk procurement, high freight, port and handling charges; seasonal fluctuations in demand, bulkiness and the high cost of finance.

### Background

Declining soil fertility, particularly nitrogen and phosphorus, is a major cause of low crop productivity in Sub-Saharan Africa. For example, almost 80% of African countries are confronted with nitrogen scarcity or nitrogen stress problems. Forty percent of the cost of fertilizer in Eastern and Southern Africa is due to transport from ports of entry to the farmers. For land locked economies, poor port handling infrastructure and trade barriers further add to the cost of fertilizer with additional costs to the nearest border point estimated at US\$ 50-100 per ton. Low access to credit by actors along the fertilizer value chain further affects demand and supply.

This is exacerbated by low returns to fertilizer use arising from use of inefficient production methods and low nutrient and water use efficiency. Crop response to fertilizer is often improved by the use of

complementary soil and water management practices such as tied ridges, crop residues and organic manure.

### What agricultural policy can do

**Harmonize the quality and quantity standard specifications for fertilizer across the region.** Enhance product quality assurance and truth in labelling in the fertilizer sector by encouraging use of smaller pre-labelled packs, strengthening the inputs inspectorate arm of government, and building capacity for self-regulation in the private sector.

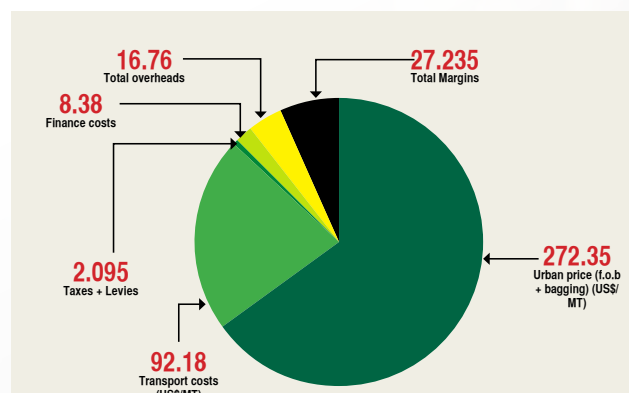
**Improve the logistics of fertilizer distribution** by investing in more efficient port and customs operations, better road and rail networks and functional retail distribution networks with rural outreach.

**Enhance access to credit and financing** to enable importers to stock fertilizer, which helps to stabilize prices during periods of high demand while enabling new entrants and hence competition in the sector.

**Streamline the fertilizer tax regime** to provide incentives for sustained private sector investment. Whereas taxes for regional trade have been harmonized, Value Added Tax (VAT) is still variable and a cause for non-uniform fertilizer prices across the region.

**Use smart subsidies** to enhance participation of smallholders who would otherwise be excluded from fertilizer markets.

**Figure 1: Tanzania cost breakdown of urea retail price in 2007 (US\$/MT) based on IFDC (2012)**



**Extension agents** should train farmers in sustainable intensification practices validated under SIMLESA that combine nutrient and water use efficiency, to increase returns to fertilizer use and enhance soil health.

**Extension agents** should foster technology-transfer support through technology transfer advisories and agro-dealers using well-tested manuals, guidelines, demonstrations, and a range of other media.

**Researchers** should establish fertilizer recommendation by crop and agro-ecological zones and provide expertise towards reducing over product differentiation in the fertilizer market.

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### ACIAR's contribution to research

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## Facts & Figures

- MLN is a destructive viral disease of maize caused by the combined infection of maize plants by Maize Chlorotic Mottle Virus (MCMV) and any member of the cereal potyvirus family, especially Sugarcane mosaic virus (SCMV). Severe infestation can result in total yield loss.
- MLN-causing viruses are transmitted not only by insect vectors, but also by seed.
- First observed in Kenya in 2011, the disease has since been reported in Rwanda, Tanzania, Uganda, DR Congo and Ethiopia. The risk of further spread across the region is high
- The disease causes serious economic losses across the entire maize value chain.
- Continuous maize production is a key driver of MLN.

# RESTORING HOPE

## Curbing the spread and impact of Maize Lethal Necrosis disease in Eastern and Southern Africa

### Key fact

Since 2011, an unprecedented threat to the region's maize based economies has emerged in the form of maize lethal necrosis (MLN) disease. Within a few years, the disease has been reported in Kenya, Tanzania, Uganda, Rwanda, Ethiopia and Democratic Republic of Congo. The effects have been devastating. USDA Foreign Agricultural Service estimates that in Kenya alone, MLN reduced maize production by 10% amounting to more than US\$ 50million during the 2014/2015. Future episodes of MLN will have far reaching negative impacts on national food security and economies.

### Summary

MLN can only be effectively prevented and/or tackled through concerted inter-institutional and multi-disciplinary actions, depicted in Figure 1. The key actions include: enforcement of synchronized maize plantings and a maize-free period of at least 3-4 months in a year in severely affected areas; creation of extension corps specifically dedicated to creating awareness on MLN management among the farming communities; and monitoring and implementation of standard operating procedures for

production of MLN-free clean seed at various points along the seed value chain, to be used by all players in the seed industry

CIMMYT developed and released, through national partners, five promising first-generation MLN tolerant maize hybrids in 2013-2014. These hybrids are in the process of up-scaling and commercialization. Several hybrids with higher tolerance to MLN are in the pipeline for release in the region.

## What agricultural policies can do

### Enforce synchronized maize plantings and maize-free windows in severely affected areas.

In areas where MLN incidence is highly prevalent, maize-free windows with rotations using non-cereal crops especially legumes should be mandated and enforced. However, this measure will not be successful unless the entire villages in MLN-affected areas implement this. Alternative crops should fulfill two pre-conditions: a) high market potential and profitability; and b) affordability and availability of quality seed of suitable non-cereal crop varieties adapted to the specific agro-ecology.

### A dynamic extension system to create adequate awareness among the farming communities.

Mobilize an extension and information delivery system dedicated to creating awareness among farming communities in both affected and non-affected areas in MLN-endemic countries regarding appropriate MLN diagnosis and management measures.

### Strengthen the national phytosanitary capacity and establish a community of practice for effective surveillance and monitoring in the region.

An effective pest/pathogen surveillance system is crucial to ensure expedient diagnosis and action. Without robust sanitary and phytosanitary systems, there is a huge risk of extensive production losses happening in the maize value chains in Sub-Saharan Africa due to spread of MLN. Linking the National Plant Protection Organizations in Sub-Saharan Africa into a “community of practice” for implementing harmonized MLN diagnostic protocols is critical for preventing the spread of MLN/MCMV from the MLN-endemic to non-endemic areas. In addition, there is an urgent need for coordinated MLN surveillance and information dissemination in Sub-Saharan Africa, possibly piggy-backing on the existing disease surveillance infrastructure. The key features of such a surveillance system should be:

- A survey network in each country using existing agricultural extension agents
- Brief and simple survey forms that are standardized for the ECA region, so each country uses the same survey.
- A dynamic, open-access MLN portal that provides latest updates on disease status in different countries, promising MLN tolerant varieties, MLN management recommendation domains, and economics of MLN management.

- Use of surveillance data to actively promote deployment of MLN tolerant germplasm in MLN affected areas

### Make MLN tolerance in maize one of the important criteria for varietal release.

Given that the surest bulwark against MLN will remain deployment of tolerant/resistant varieties, two policy measures could be immensely useful: a) fast-tracking release of high-yielding, MLN tolerant/resistant maize varieties including other relevant adaptive traits after demonstration of the tolerance/resistance in the National Performance Trials; such varieties should be targeted for deployment in MLN-affected areas, by providing special incentives to the seed companies commercializing such varieties; b) pro-actively initiate intensive measures to introgress in an accelerated manner MLN tolerance in the commercial genetic pool even in countries that are not yet affected by MLN in Sub-Saharan Africa.

## What national plant protection agencies can do

### Without MLN-free seed certification, disallow movement of commercial seed between MLN-endemic to non-endemic countries.

Immediate steps must be taken to prevent further spread of MLN, especially MCMV, through contaminated commercial seed from the MLN-endemic to non-endemic areas in Sub-Saharan Africa. Until seed companies in the MLN-endemic countries have produced 100% MCMV-free clean commercial seed and have necessary certification from the NPPO, the potential damage to maize producers from introducing MLN in the non-endemic countries significantly outweighs the benefits of commercial seed trade.

### Facilitate improved maize germplasm exchange only through appropriate quarantine sites.

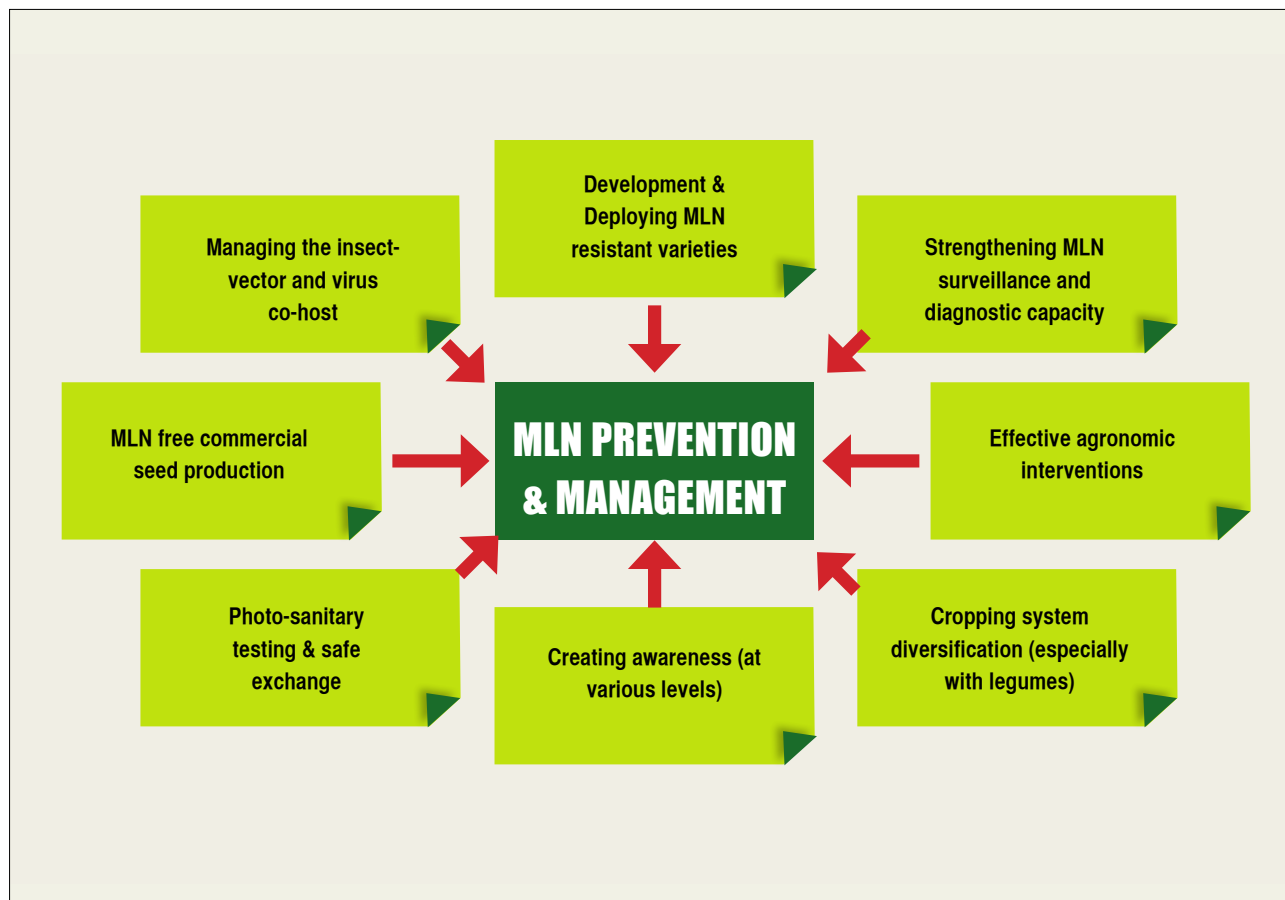
If improved maize varieties are to continue contributing to the increase in the productivity of maize in Sub-Saharan Africa, continued exchange of research materials across countries is essential. To allow the import of small lots of thoroughly tested seed of important breeding materials, including MLN tolerant parental lines, MLN quarantine sites must be established in each of the major maize-growing countries in Sub-Saharan Africa. Such sites must be away from major maize production areas and must be carefully monitored by well-trained pathologists (Mezzalama et al., 2015).

### Use accredited laboratories to issue certificates of testing for MCMV in seed and seedlings.

A regional network of certified, accredited laboratories should be established to undertake standardized testing of MLN-causing viruses, especially MCMV, in seed pro-



**Figure 1: Recommended regional and National MLN Management measure**



duction fields and in research/commercial seed lots. Certificates issued by NPPOs must clearly indicate the tests done and the results. The Kenya Plant Health Inspectorate Service (KEPHIS) imposes 1% tolerance threshold for MLN in seed production fields, and 0% in lab-based analysis of seed. Where seed is moving across international borders, the responsibility must be on the importing party to certify that seed they are bringing into the country is free from MCMV. Accredited laboratories using high throughput, standardized diagnostic methods will also serve as key resources for surveillance teams in confirming incidence and identity of MLN causing viruses. In the short-term, all seed testing laboratories should build capacity in MLN diagnostics.

### What seed companies can do

**All seed companies should implement standard operational procedures to produce MLN-free seed along the seed value chain.**

It is very important to recognize the seed transmission risk of MCMV, and implement necessary phytosanitary measures to negate or minimize the risk. All public and private

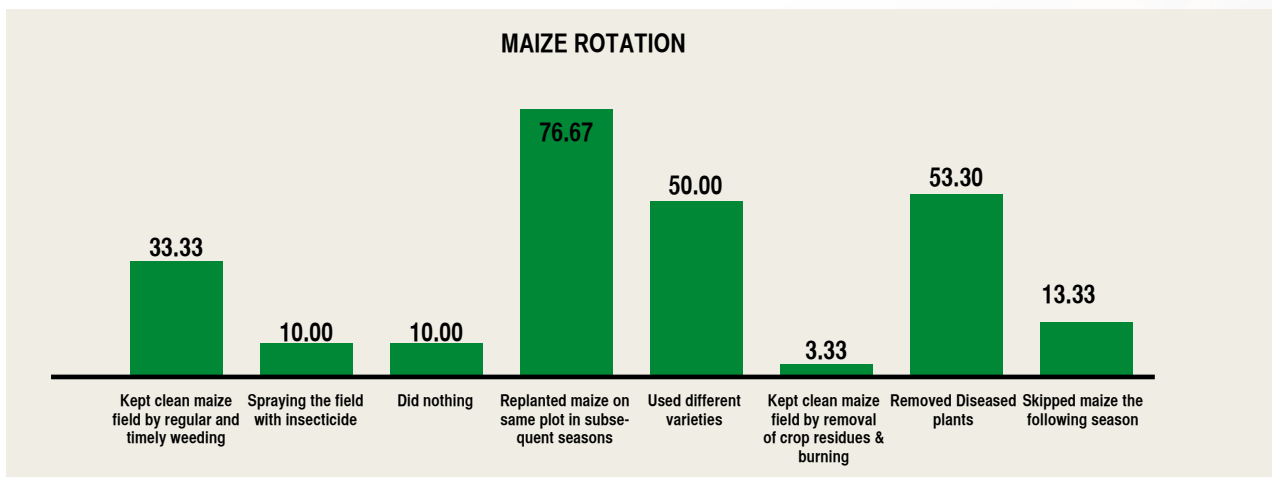
institutions involved in maize seed production, especially in MLN-endemic countries, must take rigorous measures to ensure that the seed produced is free from MLN-causing viruses, and only such seed is marketed/commercialized. Every step in the seed value chain should be planned and implemented through standard operational procedures to minimize the risk of MCMV transmission through seed. The responsibility for MLN-free seed production should rest with the seed companies. This should be instituted as a voluntary industry requirement and mandated by phytosanitary agencies.

### What extension systems and farmers do

**Good agronomic practices are essential for effective management of MLN.**

It is important for extension workers, both public and private to give well-informed, science-based, clear instructions to the farmers as to what actions have to be taken for diagnosis and management of MLN. There are proven agronomic practices that need to be implemented fully by the farmers, especially in MLN-endemic countries. These include synchronized timely planting, which is one of the

**Figure 2. Crop management practices used by farmers in Kenya to control damage from MLN**



most effective agronomic practices, maintaining clean fields with proper crop residue management, rouging and insect control, and crop rotations with appropriate non-cereal crops. In terms of good agronomy, the high levels of agronomic management suggested for seed production fields are also good for farmers' fields.

### Crop rotations and diversification.

One of the most important practices for curbing the spread and impact of MLN is crop rotation/diversification with suitable non-cereal crops. Continuous cropping of maize

without a maize-free window should be discouraged. If possible, maize should be produced only in fields that have not been in maize for at least one season. The problem is crop rotations among maize-dependent farmers in Sub-Saharan Africa is one of the least practiced management options. In a recent survey in Kenya, only 13% have implemented crop rotations (Figure 2). Breaking the crop cycle has been attributed to a slowdown in the incidence of MLN in some of the most affected areas of Kenya.

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# AT A GLANCE

## Sustainable Intensification of Maize and Legume Systems in Eastern and Southern Africa (SIMLESA)

### Background

Smallholder farming will continue to be a key driver of agriculture in Eastern and Southern Africa in the foreseeable future. This will be against a background of high population growth, which will double by 2050. The other pressing challenges are declining arable land, and climate variability.

Providing for this increasing population will be a daunting task given the current low productivity levels. SIMLESA focuses on rain-fed maize-legume cropping systems that also include livestock as an important component that provides food, income and manure.

These systems show considerable promise in boosting productivity and helping reverse the decline in soil fertility that is a fundamental cause of low smallholder productivity throughout Eastern and Southern Africa. Combinations of crop diversification practices, intercropping, rotations and minimum tillage promoted by SIMLESA have been shown to reduce risks of crop failure at farm level.

For example, farmers in Ethiopia increased their net maize income by more than 66-92% when they adopted improved maize varieties together with maize-legume rotations and minimum tillage.

In Malawi the increase in net maize and legume income ranged between 52-26% and pesticides reduction in the range of 0.4-0.6 liters per acre when farmers combined legume-maize intercropping and legume-maize rotations. Overall, conservation agriculture practices combining rotations and intercropping have increased labour productivity, water use efficiency and profitability, in the implementing communities and are be-

ing-scaled out.

In Uganda, permanent planting basins and rippers, which are major components of the recently introduced conservation agriculture package for renovation of degraded landscapes have increased maize and legume productivity by over 30%.

Farmers have also attested to the increased benefits from maize-bean intercropping as opposed to mono-cropping of either crop. SIMLESA sites in Uganda are sub-counties of low and high production potential in the cattle corridor dry lands of Nakasongola and Lira. In the two districts the project is working with 16 farmer groups with membership of between 25 to 30 farmers.

In the two sites, the challenges that are being addressed include: provision of rippers to address late opening of land; inputs such as improved seed, fertilizers to increase productivity; herbicides for weed management; and storage cribs to address post-harvest losses.

Five challenges that stand in the way of wide-scale adoption of sustainable intensification and policy options to overcome them will be the subject of discussions in the high level policy forum. The five challenges to be discussed in the forum are:

### 1. Sustainable intensification of maize and legumes production and livestock integration

Research evidence has shown that sustained application of resource conservation practices, crop diversification and livestock integration can increase productivity. The forum will discuss options of mainstreaming sustainable farming practices to increase productivity of smallholder systems.

### 2. Building on social capital for collective action

Research evidence shows that farmers belonging to groups are more likely to diversify cropping patterns. They are also more likely to build their resilience by trying out new farming practices, use improved varieties and adopt soil and water conservation practices. The forum will demonstrate practical approaches that support collective action.

### 3. Easing access to key farming inputs

Farmers who are close to markets have better access to farm inputs and can readily sell their farm produce. Such farmers are more likely to adopt maize and legume intercrops and rotations, improved varieties and improved management practices. The forum will deliberate on practical ways of enhancing sustainable access to inputs, e.g., seeds, fertilizers, and credit for successful intensification of farming enterprises.

### 4. Removing barriers to border trade

Most farmers in Eastern and Southern Africa are dependent on agriculture as the main source of income and spend a large proportion of their household budgets on food. Removing barriers to regional trade in food and facilitating access to key inputs such as seeds or fertilizers would provide farmers with incentives to supply the growing demand for food in the region. The forum will discuss ways of delivering integrated regional markets for agricultural products and inputs.

### 5. Containing Maize Lethal Necrotic disease: current knowledge

Maize Lethal Necrosis disease was first reported in Kenya in September 2011. Since then it has been reported in DR Congo, Ethiopia, Rwanda, Tanzania, South Sudan and Uganda. In Kenya, the disease had spread across most maize-growing areas causing an estimated loss of 10 per cent of national maize production equivalent to US\$ 50 million in 2014.

Rates of transmission from seed to seedling are low, but have been reported to be as high as 17% in one seed lot. Resistant varieties are still a long way to commercialization. This forum will deliberate on practical management practices that farmers and seed producers can employ to contain the spread of the disease within and between countries.

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## Contacts for further information

Participating countries: **Botswana, Ethiopia, Kenya, Malawi, Mozambique, Rwanda, Tanzania, and Uganda.**

Delegates: **Over 50 participants representing policy makers, scientists, farmers, private sector**

Organizers: **ASARECA, NARO, MAAIF and CIMMYT**

Sponsors: **SIMLESA is funded by the Australian Government and is managed by CIMMYT.**



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