

# Photo report: Africa RISING – Feed the Future SI Innovation Lab joint field visit to Tanzania **Jonathan Odhong<sup>1</sup>**



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The Africa Research in Sustainable Intensification for the Next Generation (Africa RISING) program comprises three research-in-development projects supported by the United States Agency for International Development as part of the U.S. government's Feed the Future initiative.

Through action research and development partnerships, Africa RISING will create opportunities for smallholder farm households to move out of hunger and poverty through sustainably intensified farming systems that improve food, nutrition, and income security, particularly for women and children, and conserve or enhance the natural resource base.

The three regional projects are led by the International Institute of Tropical Agriculture (in West Africa and East and Southern Africa) and the International Livestock Research Institute (in the Ethiopian Highlands). The International Food Policy Research Institute leads the program's monitoring, evaluation and impact assessment. <http://africa-rising.net/>



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# Introduction

The Africa RISING program and the Future Sustainable Intensification Innovation Lab (SIIL) recently held a joint field visit to activity sites in Tanzania. The goal of the seven-day long visit (5 – 12 March 2018 ) was to promote more cross-learning and establish potential areas for future collaboration between the two United States Agency for International Development (USAID)-funded agricultural sustainable intensification programs funded by the visiting team comprised of: Jerry Glover (USAID Bureau for Food Security), Vara Prasad (Kansas State University/SIIL), Irmgard Hoeschle-Zeledon (IITA/Africa RISING East and southern Africa [ESA] and West Africa [WA]), Peter Thorne (ILRI/Africa RISING Ethiopia), Sieg Snapp (Michigan State University/SIIL/Africa RISING), Kindu Mekonnen (ILRI/Africa RISING Ethiopia), Mateete Bekunda (IITA/Africa RISING ESA), Jovin Lwehabura (International Center for Tropical Agriculture [CIAT]/SIIL) and Jonathan Odhong' (IITA/Africa RISING ESA & WA). The team made courtesy calls to various government agricultural officials, visited activities implemented by both programs and interacted with farmers. Starting off the trip in the southern highlands (Mbeya and Iringa), the team made its way to central Tanzania (Kongwa and Kiteto districts), eventually rounding the visit off in northern Tanzania (Babati District). This photo report provides a summary of the very eventful field visit. An online version of this photo report is also accessible at: <https://spark.adobe.com/page/ITdAoZGJ3CYiB/>

## Mbeya and Iringa districts

### Courtesy call to Agricultural Research Institute (ARI) – Uyole



*Courtesy call to Agricultural Research Institute (ARI) – Uyole (photo credit: Jonathan Odhong'/IITA).*

Both Africa RISING and the Feed the Future Sustainable Intensification Innovation Lab collaborate in their activities with the ARI – Uyole to implement various sustainable intensification and farming systems research in different locations within the Southern Highlands of Tanzania.

## Commercialization of dressed bean seed and scaling to farmers through village-based agro-dealers



At Rashid Babuya's farm (photo credit: Jonathan Odhong'/IITA).

The Future Sustainable Intensification Innovation Lab (SIIL) is implementing research activities to evaluate bidirectional learning and effective extension approaches to promote sustainable intensification technologies among researchers, extension, agro-dealers, seed companies, non-governmental organizations (NGOs) and farmers. The trials aim to inform farmers and input suppliers about the performance of improved bean varieties with different combinations of fertilizers (inorganic only, organic only, neither, and both). Limited knowledge exists about the use of baby demonstrations in creating demand for the improved varieties and spurring wider adoption to catalyze the village-based agricultural agents (VBAA's) incentives to sell the inputs at commercial prices. Although the study is still ongoing, preliminary results indicate that seed dressing (using Apron Star) and fertilizer use increased the productivity of beans.

The delegation visited Rashid Babuya, a farmer/agro-dealer from Ruanda Village, Mbozi District in Mbeya Region. He is one of the farmers using the dressed bean seeds for the first time – at the onset of 2017/2018 cropping season.

The key benefits of dressing seeds include:

- It stimulates root development leading to vigorous starts, uniform growth and higher yields
- Strong against critical early season diseases
- Controls sucking pests for about 21 days / 3 weeks after planting.

'I am planting the dressed bean seed on my farm and also selling it to my fellow farmers who are interested. So far, I have sold about 600 kg (in 50 kg packs) in this cropping season,' explains Babuya.



*The SILL model for commercialization of dressed bean seeds and scaling seed access to farmers through village-based agro-dealers. Through this model, the project is reaching 17,250 farmers in Tanzania [a total of 117 village-based agro-dealers are attached to 150 farmers each (photo credit: Jonathan Odhong'/IITA).*

## **The Africa RISING – NAFKA partnership project**

Africa RISING and the Feed the Future Tanzania NAFKA ('grains') activity have been collaborating since 2015 to address persistent constraints to smallholder agricultural productivity and rural well-being in five regions. This is accomplished by introducing resilient crop varieties, diversifying and increasing food supply and income sources, improving nutrition, and addressing soil and land degradation. Utilizing a wide range of expertise, including research institutions, farmers associations, district-level extension, village-based agricultural advisors, agro-dealers, processors, and others, these efforts serve as a platform facilitating smallholder farmers to apply the latest technologies, practices, and innovations into their work.

In this partnership, NAFKA and Africa RISING collaborate to:

- introduce and promote improved and resilient varieties of food crops (maize and rice);
- disseminate best-bet agronomic management packages;
- protect land and water resources and foster agricultural biodiversity;
- improve household nutrition through introduction and scaling of quality declared seed (QDS) innovations for legume crops (soybean, groundnuts and beans); and
- introduce and promote post-harvest management technologies to reduce losses and bring quality up to market standards.

## Improved maize variety and fertilizer demonstrations



*Farmers at one of the Africa RISING – NAFKA project demonstration site at Iwalanje Village in Mbozi District, Mbeya Region (photo credit: Jonathan Odhong'/IITA).*

The demonstration site is managed by members of the Iwalanje Agricultural Marketing Cooperative Society (AMCOS) group which has 84 members. This cropping season, the farmers are being trained on the following aspects of production: maize varieties, fertilizer types, herbicide application, safe use and handling of pesticides, and correct fertilizer application rates and procedures. Through demonstration sites such as this one, the Africa RISING – NAFKA project has reached about 500 (195 women) farmers in Iwalanje Village. For clear comparison by farmers at the demonstration sites, usually one part is set-up with the usual farmers practice while the on the other side the recommended practice is set up.





*Vara Prasad was amazed at the height of one of the maize varieties being demonstrated to farmers at the Africa RISING – NAFKA demonstration site in Iwalanje Village (photo credit: Jonathan Odhong'/IITA).*

In Iwalanje Village, the Africa RISING-NAFAKA project works with about 500 smallholder farmers on variety selection, good agronomic practices, pests and disease management and post-harvest management. The project also supports a rural agro-dealer network, creating marketing links especially through contract farming and produces aggregation as well as youth involvement through training and deployment of local artisans as post-harvest machinery and spray service providers.

The Africa RISING – NAFKA project works with 600 farmers (211 female) in Nansama Village. These farmers belong to 8 different farmer associations including: Nansama Womens Group, Nansama AMCOS, Maku Group, Nansama Uboreshaji Group, Wakulima wa Mboga Matunda, Iganda AMCOS, Vijana Nansama, and Wakulima wa Maziwa Group. Like in Iwalanje Village, the smallholder farmers in Nansama have been trained on crop variety selection, good agronomic practices, pests and disease management and post-harvest management.



*NAFAKA director for input systems and productivity, Silvanus Mruma joins members of Nansama Women Group in a dance during the visit (photo credit: Jonathan Odhong'/IITA).*

Africa RISING – NAFKA project has worked with the Nansama Women’s Group, and others, to build the capacity of its members on post-harvest management technologies, aggregation, collective access to inputs as well as collective marketing. Most of the groups have seen immense differences as a result of this capacity building.

#### **Top-line livelihood enhancements from Africa RISING – NAFKA project**

Farmers in Iwalanje Village said the Africa RISING – NAFKA project has improved their livelihoods because it has helped them to

- Reduce post-harvest losses due to better storage in PICS bags.
- Increase maize harvests. The average harvest now is up from 15-20 kg per hectare.
- Reduce costs for activities such as maize shelling which used to cost TZS 1,000 per bag, now they only pay TZS 700.
- Open up of new income streams for the groups. For example, they have shelled 47,500 kg of maize was shelled earning the groups about TZS 400,000. These earnings have been reinvested by the group into savings and for internal lending to members.
- Use of PICS bags ensuring that farmers who use them earn better income at the market due to better quality grains.

## Reducing post-harvest losses



*Some members of the Nansama Women Group and Nansama AMCOS demonstrate to Jonathan Odhong' (Africa RISING) how the maize sheller machine works (photo credit: Olaoluwa Olabode/IITA).*

The shelling machine has brought to an end the back-breaking practice of shelling maize by pounding sacks – a job which was mainly reserved for women and children. The group would, however, wish to increase the machine's shelling capacity (currently 50 bags/day) so that more members can be served within a short period. The project is supporting the manufacture of a machine with the capacity to shell 500 kg/ hour for the farmers groups. This will be a massive improvement on the current sheller which does 50 bags/day.



*Jerry Glover asking farmers about the differences they have been able to observe after eight months of storing maize in PICS bags compared to ordinary storage bags. Farmers said the grains that were stored in the PICS bags stayed in pristine condition with no insect pest attacks, compared to grains which were stored in ordinary bags, which were attacked by insects (photo credit: Jonathan Odhong'/IITA).*



*Maize stored in PICS bags at a warehouse (photo credit: Jonathan Odhong'/IITA).*



*Discussion with farmers at Nansama Village market centre (photo credit: Jonathan Odhong'/IITA).*

During discussions with farmers at Nansama Village, some farmers raised the concern that the prices of the PICS bags were still high (at TZS 5,000). The project team encouraged them to continue acquiring the bags as a group because purchasing them in high volumes allowed them to get great discounts from the retailers bringing down the unit price for a PIC bag to TZS 3,500. The project team also reminded farmers that ordinary bags, which could not be reused, retailed at TZS 1,000 unlike the PICS bags which were reusable for up to four years.

## Reclaiming acidic soils



*A billboard at one of the Africa RISING – NAFKA demonstration sites in Italule Village (photo credit: Jonathan Odhong/IITA).*

Excessive levels of soil acidity limit the efficacy of fertilizers in maize-legume production systems. In certain parts of Iringa Region where this problem is persistent, the soils have a PH of between 4.5– 4.8. The Africa RISING-NAFAKA project has set up demonstration sites in Iringa Region of Tanzania, to train 600 farmers in Italule and Utengule villages in Kilolo District on how to reclaim the productivity of the acidic soils through application of lime. At least 30 of these lime application sites have been set up in Iringa.



*Interactions with one of the lead farmer on whose land the liming demos have been set up (photo credit: Jonathan Odhong'/IITA).*

The team visited the farm of Kibwana Nyalusi, a host farmer for the liming demonstration. Nyalusi notes that, like him, most farmers in Italule Village know about lime, but have not been aware that it could be used to reclaim acidic soils. Within the demonstration sites farmers can evaluate by observation the following scenarios when they grow maize: (a) apply lime, and apply fertilizer (urea, CAN and YaraMilla cereal); (b) apply fertilizer only; (c) do not apply either lime or fertilizer.



*Kibwana Nyalusi, a host farmer for the liming demonstration in Italule Village (photo credit: Jonathan Odhong/IITA).*

‘When we apply lime and use fertilizer, observable differences can be seen very early in the stages of plant growth. For example, these plants grow taller and have a wider girth than the maize plants grown on other parts of the demonstration plot where no lime was applied,’ explains Nyalusi.

‘Applying lime to soils has lifted my maize yields from an average of about 4 – 5 bags per hectare to 10 – 14 bags per hectare. This is a big change although I am still hoping that the yield can go up even further to 20 – 25 bags per hectare,’ he adds.

‘It is great that farmers are starting to see the benefits of applying lime to their soils. We have trained them on the correct measures of application (1 tonne/acre),’ said Africa RISING Scaling Specialist Haroon Sseguya.

One of the significant challenges/hurdles that remains for the Africa RISING–NAFAKA project staff is facilitating a permanent solution for enabling farmers to easily transport/access lime. The project team has initiated a partnership arrangement with SAGCOT, a public-private-partnership initiative, to help the farmers transport the lime. The team is also exploring



setting up a meeting with cement producers who could (at a fee) supply lime to farmers in the area from Dodoma, about 266 km away.

## **Village agricultural agents: frontline actors in the rural agro-input dealer network**

As part of its efforts to create sustainable productivity of maize and legumes, the Africa RISING – NAFKA project also supports a network of village-based agricultural agents (VBAs) in all the districts where it works. The VBAA's are deployed by the project to complement the government extension agents as well as to be frontline actors in the rural agro-input dealer network. During the field visit, the team visited Siza Mkini, a 24-year-old agro-dealer in Kitowo Village in Kilolo District. .



*Siza Mkini, at her agro-dealer shop in Kitowo Village (photo credit: Jonathan Odhong'/IITA).*

Mkini has been a VBAA since 2014 when she was selected by farmers in her village in consultation with the village extension officer. Since then she has been trained by the Africa RISING–NAFAKA project on business management skills, good agronomic practices for maize and beans, pests and disease management, correct application and handling of agro-chemical etc.

She is making a mark in Kitowo Village through her agro-dealer shop which she opened in 2016. 'Dukani kwa Siza' as the shop is popularly referred to within the locality is ensuring that farmers in the village now have easy access to agricultural inputs and the best advice on correct use of different agricultural inputs – almost at their door steps.

Mkini said running an agro-dealer shop is both satisfying and rewarding financially but she said that she is not in it to make huge profits out of fellow farmers, but rather to also contribute to improving the livelihoods of the community to which she belongs.

'I buy 1 bag of urea at TZS 40,000 and sell to farmers at TZS 42,000. So, the margins are not so big. But also have arrangements with my suppliers who provide me with input consignments and I pay them when I make sales. This works for both myself and the supplier who by bringing his stock to my shop is guaranteed better sales because the end users (farmers) will have easy access to those products,' she explains.

Her business model requires that Mkini diligently keeps records of all her transactions. She was trained on how to do this by the Africa RISING-NAFAKA project and she maintains up-to-date records of sales journals cash receipts , purchases and receivables. This season she has sold up to five metric tons of maize seed.

## **Legume quality declared seed (QDS) production**

Legumes have the potential to contribute to additional income for households, improve soil fertility and enhance household-level nutrition outcomes. However, despite intense interest by farmers to grow legumes such as beans, soybean, pigeon pea and groundnut, access to quality seed remains a significant challenge. To address this problem, the Africa RISING–NAFAKA project has been working to improve linkages between small local seed companies, community seed producers, and national breeding programs as a means of ensuring legume seed is easily accessible and available to farmers. The main activities in this efforts include, promotion of QDS seed production and building a vibrant QDS farmers' association in each district where the project is working. This activity is meant to enhance QDS producers' access to markets and other services such as credit, and engagement with district seed inspectors.



*Abeid Chonya, a common bean QDS producer in Mkungungu Village, Iringa Rural District (photo credit: Jonathan Odhong'/IITA).*

Abeid Chonya, a farmer in Mkungungu Village , Iringa Rural District who is producing QDS common bean seed and is also demonstrating drought tolerant maize varieties (through the [WEMA project](#)). The Africa RISING – NAFKA project is implementing the common bean QDS production activity in 75 villages in Iringa and Mbeya Regions. Farmers like Chonya produce the QDS seed with the aim of selling it to fellow farmers in their villages and surroundings.

Chonya has planted common bean variety Njano Uyole QDS on a One-acre farm. Like other QDS farmers working with the project, he was trained on the minimum standards for producing QDS.



*Abeid's QDS field (photo credit: Jonathan Odhong'/IITA).*

'I spaced the rows at 50 cm intervals and 10 cm from one plant to the next within each row. This is how we were trained. I also had to pay attention to other requirements such as 3 m isolation distance requirement,' he explains.

This is Chonya's second season as a common bean QDS producer. From his experience in the previous season, Abeid says he is planning to continue with common bean QDS seed production over the long haul. This is because he makes more selling common bean seed than when he sells the grain. After seeing how well the bean seeds performed, his fellow farmers in Mkungungu Village are already placing orders for the next season. Thanks to good training by the project team, Chonya is also making smart choices to rotate maize and common bean within his plot from one season to the next. This year, with the WEMA tego maize variety that he has cultivated, he hopes that he will get good harvest despite the abysmal performance of maize crop within the region over the past few years, thanks to common droughts. Earlier on in the season, he was also confronted by a fall army worm attack on his maize plants, but he managed to deal with them quickly by applying pesticides.

## **Africa RISING – NAFKA project achievements so far in the 2017/2018 cropping season**

- 1,000 demonstration sites for maize, soybean, and common beans established.
- 262 government extension staff trained on use of different protocols for the establishment of demonstration plots.
- 161 QDS producers trained and supported (30 tonnes of legumes, 162 tonnes of rice)
- 146 village-based agricultural agents (VBAAAs) trained and supported as rural agro-dealers.
- 50 local artisans trained in production of maize shellers and threshers.
- 130 spray service providers trained in all the project villages to provide professional pesticide sprayer services at a fee to other farmers.
- 41 grants given to 110 producer organizations for production of shellers, purchase of PICS bags for grain storage and threshers.
- Thousands of metric tons of inputs and products sold through linkages with agro-dealers.

## Kongwa and Kiteto districts

### Farmer-to-farmer learning pushing adoption of Africa RISING technologies

The team made a visit to two farmers in Ngumbi Village, Kongwa District— Dewo Kuta and Martha Paulo. The two have adopted different technologies promoted by Africa RISING although they were not part of the intervention communities. Kuta has set-up the Fanya juu and Fanya chini terraces, while Paulo has set up tied ridges on her farm. Two farmers in the same village, but with different motivations.



*Dewo Kuta (in a red hat) explains his farming methods to the visiting team (photo credit: Jonathan Odhong'/IITA).*

Kuta's decision was premised upon the fact that his land was on a very sloppy terrain and every time it would rain there would be a massive soil runoff. This situation rendered his farm almost non-arable. On her part, Paulo felt that moisture retention was the more pressing concern for her farm and hence decided to use tied ridges as an immediate measure for ensuring moisture retention after learning from a fellow farmer in the neighbouring Mlali Village where Africa RISING was implementing activities.

'The Fanya juu and Fanya chini terraces have effectively stopped the runoff on my farm. I am happy that I set them up because now as you can see, no soil erosion takes place in the farm,' says Kuta.



*Erosion remains one of the biggest challenges still faced by farmers in Kongwa and Kiteto districts (photo credit: Jonathan Odhong'/IITA).*

'During the cropping seasons, it is possible sometimes that the rains start and then stop and only resume after several days. At the early stages of plant growth, this can have lasting damage on a crop like maize. Therefore, when I learnt about tied-ridging from one of my friends in Mlali Village. I knew instantly that it was something that could make a difference for me,' explains Paulo about her first impressions of tied-ridging back in late 2016.



Martha Paulo at her farm where she is conducting different tied-ridging experiments (photo credit: Jonathan Odhong'/IITA).

Martha is also conducting different experimentations with tied-ridging in her farm. She is comparing tied-ridging with the peat method of water harvesting which they have been using in the past and the effect of tied ridging when used for sunflower crops.



Side by side: One of Martha Paulo's experiments is comparing the peat method (left) and tied-ridging (right)(photo credit: Jonathan Odhong'/IITA).

Despite the success that can be witnessed on-farm when industrious farmers like Kuto and Paulo adopt practices such as setting up the Fanya juu and Fanya chini terraces; challenges like erosion are more effectively dealt with through community level action. Going forward, the Africa RISING team in Kongwa District is at the early stages of initiating community-wide efforts within the district to stop erosion through setting up landscape level interventions. The team is also working to quantify the economic benefits of farmers adopting interventions such as the Fanya juu and Fanya chini terraces.



*Other farmers like Boaz Elias Sabai and his wife Grace (pictured) have also adopted tied-ridging after learning about it at Martha Paulo's farm (photo credit: Jonathan Odhong'/IITA).*





*Experiments and data collection on different soil and water conservation treatments have been ongoing in Mlali Village for the past four years (photo credit: Jonathan Odhong'/IITA).*

## **Genetic intensification of groundnut, sorghum, pigeon pea and drought-tolerant maize**

Genetic intensification is one of the three pillars of sustainable intensification, alongside ecological intensification and socio-economic intensification. Over the past five years, Africa RISING has been working with farmers in Kongwa and Kiteto districts to improve the crop varieties available to farmers in these semi-arid parts of Tanzania as an entry point to sustainably intensifying their farming systems. In both districts, the scientists and farmers have implemented systematic variety screening, on-farm testing and participatory variety selection for groundnut, sorghum, pigeon pea and drought-tolerant varieties. Through this work, some promising varieties have been identified and are targeted for release in 2019/2020. It is worth noting that the Africa RISING team did not do a 'from scratch' breeding program to arrive at the varieties being released to farmers, but rather leveraged on working with breeders from other initiatives to identify best-bet/best-fit varieties for Kongwa and Kiteto districts.

By testing the new improved varieties with farmers, the research team has been able to get feedback from them as well as from other stakeholders. The approach adopted by the team has been participatory by nature. Farmers, for example, have been evaluating the varieties based on their traits of interest such as drought tolerance, early maturity, ability to yield more, taste and number of pods produced per plant (for groundnut). To scale out the new varieties once the top varieties have been selected, the team plans to promote them through community seed banks.

These efforts are aligned to the current food security strategy for Kongwa District. The district strategy, which is being popularized to farmers and other stakeholders under the rallying call of 'Ondoa njaa Kongwa' (Kick hunger out of Kongwa), aims to promote the growing of drought resistant crops, particularly sorghum. The district council, however, faces a lack of improved seeds, a challenge which they have this season surmounted through collaboration with the Africa RISING team which provided them with 40 kg of improved sorghum varieties which were distributed to some farmers within the district.



*On-farm groundnut participatory variety selection in progress at farmers field in Mlali Village, Kongwa District (photo credit: Jonathan Odhong'/IITA).*

For a vast majority of farmers in Kongwa and Kiteto districts, groundnut is a good source of nutrition and income due to a limited number of cash crops. Groundnut also has additional benefits. It improves soil health through nitrogen fixation and its haulms are a cheap and rich source of animal feeds. However, farmers have limited access to improved early-maturing and high-yielding varieties of groundnut with both farmer and market preferred traits. Through Africa RISING efforts, new varieties with over 60% yield advantage over the farmer-grown varieties have been identified and scaling out efforts are ongoing.



*A farmer standing at one of the on-farm sites where the early-maturing drought-tolerant maize varieties are being evaluated in Mlali Village, Kongwa District (photo credit: Jonathan Odhong'/IITA).*

Maize is one of the most important cereal crops for people's food and income in the central zone of Tanzania. Productivity of the crop remains low in Kongwa and Kiteto districts with an average of 1.1 tons/ha due to a number of factors including frequent dry spells during crop development, extreme temperatures (heat), common use of unimproved varieties, poor agronomic practices, pests and diseases. The lack of availability of improved varieties has significantly contributed to their low use despite their commercialization. Through Africa RISING engagement, 42 intermediate maturity group and another set of 60 early-maturity drought-tolerant maize varieties are being evaluated in Kongwa and Kiteto districts with farmers to develop more locally-adapted hybrids. This year, 9 promising maize hybrid varieties have been selected from the initial set of varieties and the research team plans to include them in the national performance trials (NPT) out of which 2 of the best from each set will be selected for fast-track variety release.

## Improving child, maternal and household nutrition and market competitiveness

A majority of poor smallholder farmer households in central Tanzania, especially children and women, are affected by insufficient access to nutritious foods, low dietary diversity, under nutrition and micronutrient deficiencies. To address this challenge, the Africa RISING project team in Kongwa and Kiteto districts resolved to integrate *nutrition sensitive agricultural interventions* and *nutrition specific interventions*. The project team is linking up its efforts to improve on farm productivity of crops (introducing better yielding and drought-tolerant varieties of groundnut, maize, pigeon pea, sorghum etc.) to a nutrition focused effort where farmers are also trained on how to improve child and household nutrition through innovative menus based on these crops.

The nutrition activities aim to equip farmers taking part in these learning groups (still predominantly women) with a package of integrated technologies for improved child nutrition that can be applied concurrently to address: (i) health-related practices on the importance of breast-feeding, personal hygiene and food safety technologies and (ii) nutrition-related practices of introducing knowledge on food groups, and complementary food preparations using diversified food products.

Practical lessons on handwashing, hygiene, child-feeding, and cooking recipes have been taught to the women attending the nutrition field schools. The team has also been collecting data and monitoring diarrhea and infection-disease status of the children, effects of dietary diversity, acceptability of the new recipes coupled with periodical measurement of anthropometry (height, weight and mid upper arm circumference) to study the impact on nutritional status.

‘Before the nutrition-focused interventions started here in Mlali Village, the diet of most families was predominantly maize-based. The effects of this kind of diet were quite telling on the children under five, most of whom were stunted. This has changed now and it is observable that more and more children in the village look healthier with plump cheeks,’ explains Rehema Boniface, one of the women taking part in the nutrition field schools in Mlali.



*Two mothers from Mlali Village hold packets of the Africa RISING porridge premix that they formulated as part of the project's training activities on nutrition. The premix which is made from maize, soybean, millet and pigeon pea is loved by children for whom the ingredients provide the different food groups required for growth (photo credit: Jonathan Odhong'/IITA).*



*Women in Mlali Village are being trained on different ways to improve child, maternal and household nutrition through innovative food recipes which are based on the improved crop varieties introduced to farmers by Africa RISING (photo credit: Jonathan Odhong'/IITA).*

## Sustainable intensification in action



A visit to Moshi Maile's farm in Mlali Village gave the group a chance to see the farming systems approach to sustainable intensification deployed by the Africa RISING project. Maile is a model farmer among his peers there. He has managed to successfully implement different technologies promoted by Africa RISING at farm level into a synergistic arrangements. The technologies he has adopted from the project include: variety selection of improved crop varieties (for better productivity), rearing improved chicken ecotypes (for income and improving community breed), establishing soil and water conservation structures like Fanya juu and Fanya chini terraces (for erosion control), and establishing woodlots and fodder banks (for fuelwood supply and supply of leaf meals for poultry). The combined effect of all these improved technologies and agricultural practices has been an immense improvement in the livelihoods of Maile's family.



*Jerry Glover holding a cock of one of the improved breeds (weighing 5.5 kg!). These improved cock breeds were introduced to Maile and other farmers in Mlali Village through the Africa RISING project (photo credit: Jonathan Odhong'/IITA).*

The introduction of the improved cock breeds was so as to ensure sufficient cross-breeding with the local variety chickens towards improving the genetic stock of the local chicken ecotypes for better meat and egg production.

The other elements of this work also entailed training farmers on proper husbandry and poultry feed processing from locally available materials such as maize bran, sunflower seed cake, *Gliricidia* leaves (harvested from the woodlots), sorghum, and millet. So far 1,163 cross-bred grower chicks have been distributed to farmers. The cross-bred chicken are fast growing and can attain a live-weight of between 3.1 and 4.2 kg after just 4 – 5 months which is a good market weight. The cross-breeds are also better at producing eggs, laying on average 260 eggs/year compared to the local varieties which lay an average of 70 eggs/year. These comparative advantages means that a farmers such as Maile can get increased income and improved nutrition faster.



*A Fanya juu and Fanya chini terrace reinforced with Glyricidia and Napier grass at Moshi Maile's farm (photo credit: Jonathan Odhong'/IITA).*

Farmers are encouraged by the Africa RISING project to reinforce the terraces with either or both of these two crops which are not only good at holding the soil particles together and therefore increasing the effectiveness of the terrace but also can be used for livestock feed. Maile usually dries the *Glyricidia* leaves and grinds it for use in formulation of chicken feed.

'I have gained a lot from these combined technologies. I have, for example, built a better house from the income generated from selling these improved chicken breeds,' says Maile.





*Improved poultry housing and husbandry activities are also being implemented by the Africa RISING team in Babati District (photo credit: Jonathan Odhong'/IITA).*

## Scaling up the production of commercial bean seed



*The team made a stopover at a farm located in Babati District where SIIL has partnered with a private entrepreneur— Wilfred Mushobozi—to scale-up the production of commercial bean seed (photo credit: Jonathan Odhong'/IITA).*

The farm, which sits on 150 hectares, has been leased from a local farmer cooperative society for the next 10 years. Farmer access to certified improved bean seed is still a significant challenge to a majority of farmers in most parts of Tanzania. However, Mushobozi believes that this is a business niche so far ignored by many big commercial seed companies. Operations on the farm started in November 2017, and he is upbeat that his venture will succeed.

Through this activity, SIIL aims to showcase and designate the farm as an agricultural technology park where neighbouring farmers can come and learn about improved bean production. In the public-private-partnership arrangement, SIIL will provide Mushobozi with improved bean seed for multiplication.

'Although we just started last year, the objective of using this farm as a technology/learning site for farmers is already being met. To the amazement of many neighbouring farmers we recently just harvested Irish potatoes and planted beans almost immediately after. This is already causing farmers to realize that they can intensify their agricultural production immensely in this location that is historically very fertile,' explains Mushobozi.



*This bean shelling machine prototype and other technologies will also be part of the array of improved technologies that will be demonstrated for farmers at Mushobozi's farm. This shelling machine prototype which (still is being enhanced) uses 0.3 litres of petrol to thresh 295 kg of beans/hour. This translates to a labour saving of 73% when compared to manual threshing of beans. The machine is seven times more efficient compared to manual threshing (photo credit: Jonathan Odhong'/IITA).*



*SILL is partnering with Wilfred Mushobozi (centre), an entrepreneur, to use his farm as an agricultural technology park (photo credit: Jonathan Odhong'/IITA).*

## Babati District

### Sustainable intensification through optimization of maize–pigeon pea/lablab cropping systems



*A lablab plant (photo credit: Jonathan Odhong'/IITA).*

Lablab once fed much of Africa, largely through household garden production by women. During the colonial era, the crop was lost to most African households. However, with today's challenges of food insecurity induced by climate change and soil degradation, there is a clear need for reintroduction of this dual-purpose crop that doubles up both as human food and animal fodder in eastern Africa where it was predominantly grown in the past.

Little information is available, however, regarding lablab nitrogen fixation potential across environments, and the crop management options for optimization of maize-legume intercropping systems within different agro-ecological conditions. This work is supported by SILL and is being spearheaded by Esther Mugi as part of her PhD research at Wageningen University.



*Esther Mugi in the field, explaining her research work (photo credit: Jonathan Odhong'/IITA).*

## Bura Aitoo– An early adopter and adapter



*Bura Aitoo is a 54-year-old small-scale farmer and father of seven children (six boys and a girl) in Hallu Village, Galapo Ward, Babati District (photo credit: Jonathan Odhong'/IITA).*

Before joining the Africa RISING project activities in 2014, he used to plant non-improved or more than 4–5-year-old recycled maize and pigeon pea seeds on his 2-hectare plot. He did not plant at the recommended spacing, and neither did he apply any mineral fertilizer besides small amounts of farm yard manure, which had not been properly stored. Due to these conventional practices, he used to obtain poor/low maize yields of 1.25 tonnes per hectare (t/ha), whereas the pigeon pea yields were 0.75 t/ha.



*Photo credit: Jonathan Odhong'/IITA.*

In 2014, he heard about the maize–pigeon pea intercropping technology being tested by the Africa RISING program. The technology consisted of intercropping improved maize and pigeon pea seed at an inter row spacing of 100 cm and 50 cm in between rows using 20 kg P/ha at planting, from different sources of Phosphorus fertilizers. The different sources of P fertilizers were Di-Ammonium Phosphate (DAP), Minjingu Mazao, and Minjingu Hyperphosphate (granular).





Photo credit: Jonathan Odhong/IITA.

When he used the technology, average maize yields rose to 5 to 6 t/ha, and pigeon pea from 1–2 t/ha depending on the weather conditions.

Using an average price of TZS 500 /tonne of maize, and TZS 1,600 /tonne for pigeon pea as an average for the past 3 years. The table below provides a comparison of the increase in incomes per ha achieved by Aitoo as a direct result of adopting the technologies promoted by the Africa RISING project.

<b>Crop</b>	<b>Yields before Africa RISING (AR)</b>	<b>Average yields after adoption of AR technologies</b>
Maize	1.2 t/ha	5–6 t/ha
Pigeon pea	0.2	1–2t/ha
Income per ha from both crops	774,591 (USD 387.30)	4,045,600.00 (USD 2,022.80)

From his improved income he has paid school fee for his children, bought a motorcycle that he uses for trips to the market centre, dug a borehole in his compound to provide fresh water to his family and is also now growing vegetables irrigated with water from the borehole.



*Africa RISING ESA Project chief scientist Mateete Bekunda (right) was quite impressed by Bura Aitoo's experiments and his articulation of the objectives of his trials (photo credit: Jonathan Odhong'/IITA).*

The marked increase in his income after adopting the improved technologies have had a lasting impression on Aitoo. He believes he can even earn more. As a result, he has set-up his own experiments in one corner of his farm, to assess different crop arrangements and spacing options that could give him a better income.

'Africa RISING trained me on how to do the best intercrop arrangement for maize and pigeon pea. They also introduced me to the Lubango maize variety– a high-performing, drought-tolerant maize variety. I have seen the advice pays off in a big way, but as a good farmer I need to also figure out how to improve on what I learn. This is why I am also currently testing the same arrangement with a different maize variety – SEED Co. 627 ,' notes Aitoo with a chuckle.

In his experiments, he is also assessing how the different maize varieties and pigeon pea intercrops perform when different fertilizers are applied. For example, on one part of his experimentations he has applied DAP (as he was advised by Africa RISING scientists) and on the other part he has applied Minjingu fertilizers.

Asked about his initial thoughts of the mini-experiments, he said that he would like to suspend his judgement on the experiments until harvest time when he will evaluate which trial performed well in terms of yields for both maize and pigeon pea.

## **Africa RISING technologies transitioning from one generation to the next**

Olais Lukumay is 21 years old. At the end of last year (2017), he completed a diploma in accounting. Unlike majority of his schoolmates who have decided to go to Dar es Salaam to seek employment in big corporations, Lukumay opted to come back to his native Bermi Village in northern Tanzania to focus on vegetable farming and poultry production.

'I opted to come back and farm because I learnt first-hand from my mother how much income one could generate from agriculture – with the right technologies, know-how and efforts,' notes Olais.

Veronica Lukumay (his mother) has been involved in farming for over 20 years as her sole source of income. In 2013, she joined Africa RISING activities as part of the pioneer group of farmers who were at first participating in trials of improved technologies, and after seeing the benefits went ahead to adopt them. She participated in trials and demonstrations of technologies such as improved vegetable varieties and their corresponding good agricultural practices (GAPs), improved poultry production, and improved livestock feeding. Little did she know that her participation in these trials and demonstrations and her subsequent success with each of them was making a lasting impression on her children – Lukumay being the most interested among them.



*Forage chopper machine at Veronica Lukumay's homestead (photo credit: Jonathan Odhong'/IITA).*



*When forage is chopped, cows feed and digest it better resulting in increased milk output (photo credit: Jonathan Odhong'/IITA).*

Since returning to Bermi, Lukumay has become more closely involved with some of the initiatives started by her mother who is now 55. He is taking over the poultry and vegetable ventures from his mother.

But his interest in farming was not an overnight development. It has grown over the years.

'Back in 2013/14, I thought that farming was for youth who failed in academics and did not have other alternatives. I also believed that agriculture was mainly a subsistence venture. There was little money to be made,' notes Lukumay reflectively on his past misconceptions of farming. 'My rather negative attitude towards agriculture stemmed from witnessing my mother's challenges mainly occasioned by the traditional practices she practiced,' he says.

In 2015, when his mother shifted to implementing the improved technologies from Africa RISING such as growing elite varieties of indigenous vegetables, adopting improved poultry and the corresponding practices such as feeding and better housing, Lukumay realized that her mother was now making a profit from farming activities. From the income she was getting, she could now, for example pay, for his school fees without any hitches.

As a result, during every time he was home for holidays, he became more involved in managing research demonstration trials for improved technologies which were under his mother's care. These trials served as a farmer field school where her mother and fellow farmers in Bermi Village learned how to implement the improved technologies. In the process, he also learned more about the technologies that the farmers were being trained on by Africa RISING staff.

'I was happy to see Lukumay get more involved in farming during the holidays. For me this was good because it made sure that he was not involved in any mischief within the village as most of young people are prone to during their holidays. Little did I know that we ignited his deep interest in farming through these activities,' explains his mother.

For her, the fact that her son has mastered the different technologies from improved vegetables and GAPs, improved poultry husbandry, operation and use of fodder chopper is a big bonus. The Africa RISING technologies are now a legacy that she considers to have been passed down to the next generation in her family.

Whenever and wherever he can, Lukumay tries to influence his friends in Bermi Village to get into farming. Some of his friends are heeding his call and starting their own poultry broods with the corresponding improved husbandry practices promoted by Africa RISING.



*Olais Lukumay holding his mini-electric egg hatcher (photo credit: Jonathan Odhong'/IITA).*

In poultry production, he has gone an extra step forward and has started an artificial hatcher—an aspect that was not part of the practices promoted by Africa RISING. He has decided to do so because he sees the potential in it. Although he is encountering difficulties in this venture like low hatching percentages and unstable electricity supply, he is not deterred.

## Low-cost screenhouses and automated irrigation kits revolutionizing vegetable production in Babati District



*A screenhouse (in the background) in Gallapo Village (photo credit: Jonathan Odhong'/IITA).*

The introduction of low-cost screenhouses coupled with automated irrigation kits is taking peri-urban vegetable production in Babati District, Tanzania, to the next level. The low-cost screenhouses provide an artificial crop environment through the use of soil covers and plant covers to control soil and aerial pests and climatic conditions while the automated irrigation kit helps farmers to use water resources more efficiently in growing vegetables. The result of these two components is: better agricultural practices, better yields, and better-quality vegetables into the market.

The screenhouses cost about USD 300 (lower when local materials are used). They are designed by Worldveg in collaboration A to Z Textiles Limited, a private firm operating in Tanzania. The automated irrigation kit (Smart Agricultural Research Optimization System – SAROS) is being piloted by the International Center for Tropical Agriculture (CIAT).



*Comparing vegetables produced inside the low-cost screenhouse (right) vs those grown outside in Gallapo Village (photo credit: Jonathan Odhong'/IITA).*

Through the Africa RISING project, data is being collected about the value addition of these revolutionary technologies in Gallapo and Seloto villages of Babati District in northern Tanzania.



*The SAROS irrigation kit is housed within the metallic box in the corner of the screenhouse. The water tanks (blue color) are stationed outside the screenhouse (photo credit: Jonathan Odhong'/IITA).*

The SAROS irrigation kit automatically monitors water use based on actual climate-smart data and knowledge, hence its moniker 'smart irrigation kit'. By keeping tabs and using the real time data to 'decide' whether it is time for plants to get that much needed precipitation or not; the kit also reduces water wastage.



*The screenhouse keeps insects and pests from damaging the vegetables growing inside (photo credit: Jonathan Odhong'/IITA).*

Early indications from a review of the combined use of the low-cost screenhouses and the irrigation kits use are that the technology will help smallholder farmers use the increasingly scarce water more efficiently. Monica Pascali, one of the farmers involved in the piloting the use of screenhouses and irrigation kits says the fact that the SAROS kit is solar powered allows her and fellow farmers to use without electricity. She adds that it reduces her labour demands and drudgery because it adapts to the specific amount of crop water demand by using a real-time system for monitoring the farm environment. An in-built soil moisture sensor auto-triggers irrigation based on soil water deficits resulting in 40% less water use and 60% labour savings.





*Two women farmers evaluate the performance of tomatoes and sweet pepper grown in the low-cost screenhouse (photo credit: Jonathan Odhong/IITA).*

More and more farmers are intrigued by the innovative technology. Veronica Dodo is one such farmer. She is a member of Seloto Farmers Group which is made up of 35 members (15 women, 20 men) who also want to learn.



*Veronica Dodo (photo credit: Jonathan Odhong'/IITA).*

In 2017, Veronica provided part of her land for the technologies to be demonstrated in producing tomato and sweet pepper vegetables. The screenhouse is now used as a resource training centre by more than 50 people including Dareda Hospital workers who would like to produce healthy vegetables (no chemicals) for consumption by patients.

In the previous season, a higher marketable yield for both tomato and sweet pepper was obtained from the screenhouse compared to the open field where insect pests such as aphids (*Aphis gossypii*) and tomato leaf miner (*Tuta absoluta*) and fruit borer reduced marketable yields. Only 58% was marketed from open fields (Table 1).

Table 1. Yield and marketable yield from screenhouse and open in Seloto

Location	Variety	Total yield (kg)	Yield(kg/m <sup>2</sup> )*	Total marketable (kg)	Percent of marketable surplus	Number of tomato leaf mines and aphids per plant in the 6 <sup>th</sup> week.
Seloto	SWI	124.3	12.4	113.6	91	0**
	SWO	269.6	27.0	253.5	94	0.02**
Seloto	TMI	262.9	26.2	252	96	8.1
	TMO	278.0	27.8	162.6	58	0

Notes: TMI-Tomato inside screen house; TMO-tomato in open field; SWI-sweet pepper in screen house; SWO-Sweet pepper in open field. \* Plants were planted in three beds measuring 1x10 meters; \*\* Show average number of aphids on sweet pepper.

## Resources

- Africa RISING website - <https://africa-rising.net>
- Photos in this story on Flickr - <https://flic.kr/s/aHsmi2sKgM>
- This photo report on Adobe Spark - <https://spark.adobe.com/page/ITdAoZGJ3CYiB/>