



Keeping deadly poison off key crops along the value chain

Increasing crop production does not always lead to more food and a healthier population. In some cases, the consumption of the crops and their products may instead lead to serious health problems in both human beings and livestock and even death. One such instance is when the crops are contaminated with mycotoxins, poisonous substances produced by naturally occurring fungi that attack crops while in the field and in all handling practices before, during, and after storage.

Some of the well-known mycotoxins include aflatoxins, which are produced by the *Aspergillus sp.*; and fumonisins which are produced by *Fusarium sp.* Aflatoxins are carcinogenic and can lead to death in acute poisoning cases. *Fusarium* is suspected to reduce body immunity and retard the growth of children

One of the objectives of the AfricaRising project is to ensure the food produced by farmers in the target areas is free from mycotoxins or has levels that are within the allowable limits and therefore fit for human and livestock consumption and for regional and international trade. This is by analyzing the levels of mycotoxins in maize and beans along the value chain.

So far, over 700 samples of maize and beans have been collected from households in three villages in Babati District: Seloto, Sabilo, and Long. The researchers collected samples of maize and beans from the field and beans from storage. The team will soon collect maize from storage to complete the targeted quantity of samples required for the analysis.

The researchers also used the opportunity to create awareness on mycotoxins among farmers, village heads, and extension staff



Farmers threshing beans on the floor.

and distributed factsheets which have been translated into Swahili on mycotoxins.

“Once all the samples are collected and the analyses accomplished, we will be able to determine if the levels of mycotoxins in the targeted villages are alarming or not and this will determine the next course of action. The results from the analyses will be compared and related to the information collected from each household that provided samples to be able to determine if there are any practices contributing to mycotoxin contamination”, says Simon Boniface from the International Institute of Tropical Agriculture (IITA), who is working on the project.

Boniface says contamination of the crops occurs either in the field as these fungi are naturally found in the soil or at any stage during harvesting, handling, and storage. Contaminated crops remain infected as currently there are no effective and reliable means of decontamination.

“The most available means of controlling and managing the problem is to avoid creating a conducive environment for the fungi. Alternatively, biological control using a strain of the same fungi but which do not produce toxins has proved very effective in controlling the toxin producing strain in other countries like USA and Nigeria to control aflatoxin produced by *Aspergillus sp.*” he said.

He points out that the common practice of spreading maize and beans on the bare ground to dry in the area can lead to contamination of the two important food crops in the area as the fungi are found in the soils.

This component of the project is being led by Fen Beed of IITA in partnership with Dr Martin Kimanya from the Nelson Mandela African Institute of Science and Technology (NM-AIST). It also involves an MSc student from Sokoine University of Agriculture (SUA).



A farmer spreading beans on the floor to dry.



Samples of maize collected for analysis.

Project boosting productivity of farmers' traditional mixed farming systems

"I like variety 5. The cob has many rows and the grains have filled the cob well. There are also two cobs on the maize stalk," Esther Liberati, 43 year-old farmer from Seloto village in Babati district in Tanzania, explains her number one choice from a set of ten different types of maize being tested for adaptability to the region. This is after she painstakingly accessed each of them, feeling the weight of the cob and even counting all the grain rows to make her selection.

Esther was among the over one hundred farmers who took part in a series of Farmers Field days organized by the AfricaRising project in her village, which is one of the project's action sites. The field days had three objectives; the first was to demonstrate to the farmers improved farming methods including proper spacing when intercropping maize and pigeon pea and the use of organic fertilizer.

The second was to involve farmers in the selection of improved high-yielding and drought-tolerant varieties that are suitable to the region but which also meet their preferences and lastly, to collect baseline information on farmers in the area as part of the project's monitoring and evaluation activities.

The field days were held in Seloto and Dulang villages in Babati district, Manyara Region, Northern Tanzania.

Organizations involved in the field day included the International Institute of Tropical Agriculture (IITA), the International Maize and Wheat Improvement Centre (CIMMYT), Selian Agricultural Research Institute (SARI), and the International Food Policy Research Institute (IFPRI).

Selecting the top four

According to Jumbo McDonald, a maize breeder with CIMMYT, they wanted to select the four best performing varieties/lines from the list of ten. Three of them were already released varieties from SARI and a private seed company being grown in other parts of the country while seven were new breeding lines including a three-way cross hybrid.



Some were lucky—they received vouchers for either fertilizer or seeds for the next planting season as part of the project's efforts to encourage the use of fertilizers and improved maize varieties.

"We are looking for varieties that do well under drought conditions to give farmers options in the face of climate change. We are therefore testing these varieties for adaptability to the environment in Babati and we are involving farmers to ensure we also take into account the factors they consider important in our selection," he explained.

If any of the new lines emerge among the most preferred, they will then be forwarded to the National Maize Research Programme for national performance trials before they are formally released by the National Seed Release Committee for the region.

"The farmers traditionally intercrop maize with beans, pigeon pea, and sometimes even sunflower. They are looking for maize varieties that intercrop well. Some maize varieties are very high yielding but they have large canopies that hinder the growth of the legumes," added Ruhende Yangole, a Principal Agricultural Field Officer from SARI in Arusha.

Early adopters

Samueli Pero, 36 from Dalang village is one of the farmers who has donated a part of his farm for the demonstration and says he will try out the new improved farming practices on a portion of his farm in the coming planting season.

"I have seen how well some of the varieties are doing due to the use of modern farming methods. The spacing is different and there are only two crops being grown together. Usually in our farms we grow maize, beans, pigeon peas, and even sunflower together. Our spacing is too wide since we use animal plough. We also do not use fertilizer, instead use farmyard manure from our livestock but sometimes, it's not enough for the whole land," he said.

The climate in the area, similar to many other places in the continent has been changing over the years due to global warming. For example, explains, Festo Ngulu, from IITA who is working with the project in Babati, "In the last ten years or so, the short rainfalls, named *Mvuli* in Swahili have been very erratic and farmers no longer count on having two farming seasons every year.

"Furthermore, the area is facing rapid population increase leading to shrinking of farm sizes and soil fertility is declining due to limited use of fertilizer by farmers to replenish the soil nutrients.

"The farmers therefore need support to increase the production and productivity of their lands without causing any negative impact on the environment, soils and water resources. This is the mission of the AfricaRising project."



The young and the old taking part in the exercise to select the maize they liked the most. That which they liked the most they marked with a piece of red wool.



Collecting data from the farmers.

Climbing beans doubling yields

Climbing beans are turning out to be one of the winning innovations being introduced by the AfricaRising project in Babati district, Tanzania. The beans have tendrils which coil around supporting stakes or strings and can grow as high as 2 meters tall and produce many pods and leaves.

According to Edgar Lyakurwa, an extension officer with the Ministry of Agriculture Food Security and Livestock for Babati the climbing beans that were demonstrated in ten farmers' field in Seloto and Long villages, have amazed the farmers in the area with their high yield. They are also harvested over a long time providing continuous food for the family.

"Farmers love the climbing beans because they are able to harvest them more than once compared to the normal bush beans they grow," he said. "The beans are tied either to a stake or a string and can grow to be as tall as a person. The farmers start harvesting the pods from the bottom and they can continue harvesting for even up to one and half months," he explained.

He added that the beans have many leaves



Farmers examine the performance of climbing beans against their own bush beans.

and help protect the soil cover and also enrich it with organic matter.

Rich in proteins, beans are one of the important crops for the communities living in Babati who boil it with maize to make their local dish "makande". They

are also an important source of income. The beans also help to enrich the soils through nitrogen fixation.

The climbing beans yield nearly twice as much as the ordinary beans the farmers are used to growing says Festus Ngulu, one of the project staff from IITA. "You can compare climbing beans to constructing a multi-storey building. It makes efficient use of apical space to accommodate more people within a unit area as compared to single storey unit," he said.

He says to maximize the yield potential, the farmers are encouraged to stake as early as 10–14 days after emergence of the seedling. The stakes are inserted into the soil close to the young plants whose tendrils coil around the stakes for support to the stems as they grow upwards. Alternatively, farmers can use string tied to poles instead of the stakes.

This component of the project is being handled by the International Centre for Tropical Agriculture (CIAT) in collaboration with the Selian Agricultural Research Institute (SARI).



Placing the stakes at the right time is very important.

First generation pro-vitamin A-rich open-pollinated maize varieties released

The first generation of pro-vitamin A-rich orange open-pollinated maize varieties was released by the Institute for Agricultural Research (IAR) in Nigeria in June. IITA, in partnership with IAR, developed these varieties using conventional breeding in a project funded by the HarvestPlus Challenge Program of CGIAR. The development of these varieties is part of strategies to prevent the prevalence of vitamin A deficiency.

These varieties were released by the National Variety Release Committee of Nigeria as Sammaz 38 and Sammaz 39 and are recognized as IITA synthetic PVASYN2 and PVASYN8. The pro-vitamin A-rich orange maize varieties are the product of more than eight years of development and testing of varieties

formed from inbred lines with enhanced levels of pro-vitamin A. Other collaborating partners involved in testing include the Institute of Agricultural Research & Training (IAR&T), the University of Maiduguri, and the National Centre for Genetic Resources and Biotechnology (NACGRAB).

The HarvestPlus project works with the private sector and community-based seed producers in Nigeria to speed up the process of production of good quality seeds of pro-vitamin A-rich varieties for smallholder farmers. The two varieties can supply increased vitamin A levels in the diets of millions of children, pregnant women, and nursing mothers who consume maize every day in various traditional forms and as a local weaning food in Nigeria.



Provitamin A-rich open-pollinated maize

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An IITA Research Fellow wins the 3rd Prize of the 3rd Africa-wide Women in Science Competitions held in Accra during the 6th Africa Agricultural Science Week

Akaogu Ijeoma, presently a PhD research fellow of IITA and also a graduate student of the Ahmadu Bello University Zaria was awarded the third prize of the 3rd Africa-wide women and young professionals in science competition held in Accra during the 6th Africa Agricultural Science Week organized by FARA. The competition was instituted in 2008 by a consortium of CTA, FARA, IFS, ANAFE and RUFORUM with the support of NPCA and AGRA as associate partners to allow the voices of Africa women and young professionals in science to be heard in national, regional, and international policy forums and to encourage and support them to participate in policy processes and in agenda setting events. Based on the lessons learned since the launch of the 1st and 2nd Africa-wide science competitions in 2008 and 2010, the 3rd Africa-wide Women and Young Professionals in Science Competitions titled *Feeding 1 billion in Africa in a changing world* was held in Accra during 15–20 July 2013.

The 2013 competitions sought to recognize and reward the contributions of women and young professionals involved in:

- Pioneering and innovative research, technology development and engineering;
- Communicating their research results and technological developments to improve agricultural performance, enhance livelihoods, and build resilience of African communities; and
- Advocating for policy change and influencing policy processes through their research, education, and outreach programs to transform the agricultural and rural sectors, reduce hunger, improve prosperity, and sustain the natural resource base.

The competitions also sought to raise awareness of the need for valuing and sustaining the engagement of women and young professionals in science and facilitating their contributions to Africa's socioeconomic transformation.

In response to these scenarios, the 2012/2013 competitions were launched in March 2012. In total 316 submissions were received for both competitions



Ijeoma

(Eastern Africa: 105; West Africa: 129; Central Africa: 45; Southern Africa: 31; Northern Africa: 6;). These abstracts were evaluated by a panel of experts based on the following criteria:

- Logic
- Content
- Communication
- Impact
- Innovativeness and originality.

Forty-five top entrants including Miss Akaogu were selected to develop their abstracts into full papers using standard guidelines. They then participated in the *Scientific Writing, Communication and Advocacy Workshop*, which was held in conjunction with the 3rd RUFORUM biennial conference from 24 to 28 September 2012 in Uganda. Twenty finalists; 10 for each category, were selected to compete for the top five places in each competition during the 6th Africa Agricultural Science Week organized by FARA in Accra, Ghana. The winners were announced during the closing session of the FARA General Assembly on 20 July 2013.

Miss Akaogu who is also a staff of the National Biotechnology Development Agency in Abuja, Nigeria won the 3rd prize which comprised a laptop, books, and USD 2500 cash. The first prize of the competition was won by Dr Nafiisa

Sobratee of Mauritius with the presentation titled, "Valorisation of poultry litter to compost: an assessment of the pathogen reduction potential", while the second prize was won by Dr Florence Beatrice Lubwama Kiyimba of Uganda with the presentation titled, "Labour saving tools for women: The forage chopper for smallholder dairy farmers in Uganda".

Miss Akaogu, won the third prize with a presentation titled 'Agronomic performance of extra-early maize hybrids under stress and non-stress environments in Nigeria'. This paper was based on her MSc thesis research conducted in IITA from 2010 to 2011 under an AGRA scholarship. The thesis research was supervised by Dr Badu-Apraku, a maize breeder at IITA and Prof Victor Adetirimin of the Department of Agronomy, University of Ibadan. Results of her pioneering study showed that out of 121 extra-early hybrids evaluated under *Striga* infestation, managed drought stress and optimum growing environments in Nigeria, the IITA extra-early hybrids (TZEEI 71 x TZEEI 79, TZEEI 67 x TZEEI 63, and TZEEI 81 x TZEEI 95) were the highest yielding and most stable both under *Striga*-infestation and drought stress that occur during the flowering and grain-filling periods. Based on her studies, it was concluded that extra-early hybrids which are not only drought escaping but also possess genes for tolerance to drought at flowering and grain-filling periods as well as *Striga* resistance genes are available in West and Central Africa. This is the first report of extra-early hybrids with genes for tolerance to drought at flowering and grain filling periods and *Striga* resistance in WCA.

Extra-early maize is an important staple crop and is required for filling the hunger gap in the savannas when food reserves are depleted after the long dry period and for green maize in the peri-rurban areas of the forest zones. Promotion of the adoption and commercialization of the new hybrids will contribute to food security and improved incomes of farmers in WCA.

First generation pro-vitamin A-rich open-pollinated maize varieties released

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These varieties are easy to multiply and disseminate and will provide not only increased levels of pro-vitamin A but also higher yields to farming communities.

The national food consumption and nutrition survey in Nigeria show that nearly 30% of children younger than five years suffer from the ravages of vitamin A deficiency along with 19% of pregnant

women and 13% of nursing mothers living with a high risk of vitamin A deficiency.

These pro-vitamin A-rich maize varieties will contribute to preventing the adverse effects of deficient diets, particularly for women and children living in rural and urban centers that depend on maize as a major source of their sustenance.

Bioscience Center's website wears a new look!

The IITA Bioscience Center team is pleased to announce the release of its newly redesigned website. The Center has changed the website's layout, simplified the navigation, restructured the content, and included more features. Visit the new website at <http://bioscience.iita.org/>.