



Above: A group of houses in a Nigerian village.

Farmers Embrace AflaSafe™, the First Indigenous Aflatoxin Biological Control Product in Africa

The AATF, IITA, USDA-ARS and other partners have developed an indigenous biological control technology, named AflaSafe™, to mitigate aflatoxin contamination in maize and groundnuts. In 2009, nearly two tonnes of AflaSafe™ was deployed to 86 farmers in five zones in the Kaduna and Oyo States of Nigeria. The farmers embraced the technology and remarkable differences were observed in maize and groundnut crops.



In many countries of Africa, high levels of aflatoxin – a highly toxic, carcinogenic poison produced by a few species of *Aspergillus* – are found in food grains including maize, cassava, sorghum, yam, rice, groundnut and cashews. Most smallholder farmers are unable to prevent aflatoxin contamination during the production and storage of their crops. Moreover, as is the case in many developing countries, African governments often lack cost-effective ways to test for these poisons. As a result, many people in Africa may be chronically exposed to aflatoxins in their diets, putting their health and lives at severe risk. In addition, African countries lose millions of dollars each year due to the rejection of commodities that fail to comply with food safety and quality standards.



The International Institute of Tropical Agriculture (IITA) has been researching new, cost-effective bio-control methods that can reduce the threat posed by aflatoxins to consumers across Africa. This approach involves establishing benign strains of selected *Aspergillus* strains in the soils around crops as they grow. The goal is that the benign strains will out-compete and largely eliminate the aflatoxin-producing strains of the fungus. Based on successful laboratory and on-station field trials, AATF, IITA and the United States Department of Agriculture Agricultural Research Service (USDA-ARS) have established a project for the development and dissemination of a locally adapted microbial for controlling aflatoxin in maize and groundnuts. The objectives of this initiative include obtaining regulatory approval and gathering more efficacy data of the biocontrol product through farmer-scale evaluation, prior to commercialisation.

AflaSafe™ – first indigenous aflatoxin biocontrol technology in Africa

In 2009, IITA and USDA-ARS developed an indigenous biological control product, named AflaSafe™, which contains a mixture of four atoxigenic strains originating from Nigeria on sorghum grain as a carrier.

As with any new product, much documentation was required before AflaSafe™ could be deployed in farmers' fields. Through the services of a trademark and patent lawyer hired by IITA and working with an IITA consultant, a trademark approval for AflaSafe™ was obtained from the Nigerian Trademark Registry Office in Abuja. Due to time limitations, the partners decided to seek a 'listing' status for AflaSafe™, pending full registration, from the apex Nigerian regulatory body, the National Agency for Food and Drugs Administration and Control (NAFDAC). A 'listing' status enables the testing

Alhaji Sanusi

My name is Alhaji Sanusi and I am a farmer from Zaria, Nigeria. I have been farming for ten years now, mainly cultivating maize. For a long time, like many other farmers in my region, I considered the lack of implements, such as fertiliser, to be the main constraint in my efforts to grow this important cereal. In fact, for a long time I was not totally aware of aflatoxins.

Although I would observe the fungi on the maize grains, I did not have proper understanding of its dangers. I can say that I did not take the problem seriously enough. A few years ago, I heard that the IITA researchers were conducting research in a nearby farm. I got interested in what they were doing and I invited them to visit my farm. When they came to my farm, they were impressed by the efforts I had put in. Since then, we became good friends and they have been providing me with advice from time to time on many farming issues.

IITA researchers then invited me to a workshop on aflatoxins held at their centre in Ibadan, that is when I learnt about the profound effects of aflatoxins on people's health as well as economically. When IITA developed AflaSafe, my farm was selected as a site for the trials. As a matter of fact, mine was the first farm in the whole of Nigeria to be applied with the product. My workers and I have been keenly observing the progress of the maize on the plot where AflaSafe has been applied. We are encouraged by the improvement, as we have so far not noticed any fungi on the grain. My wish is that the product will be made readily available to all maize farmers in the region.



Left: A farmer spreading AflaSafe™ in a maize field in Nigeria.

of the technology in up to 100 hectares of farmers' fields, under 'real life' situation, thereby allowing the manufacturing and testing of AflaSafe™ so as to gather more efficacy data.

Enthusiastic response from farmers

During June and July 2009, nearly two tonnes of AflaSafe™ was produced in IITA using a laboratory scale manufacturing protocol. A packaging system, comprising product labels and safety instruction sheets, was then developed. This enabled the transportation of the inoculum safely to northern Nigeria, where, in collaboration with the Kaduna State Agriculture Development Project and United Nations Development Programme (UNDP) Pampaida Millennium Villages Project, AflaSafe™ was deployed to 86 farmers in five zones in the Kaduna and Oyo states.

The deployment of AflaSafe™ commenced on 11 August, in collaboration with partners in Maigana, Lere and Birnin-Gwari zones, a cluster of several villages under the Pampaida project, all in Kaduna State, and one village in Ogbomosho Local Area Government in Oyo State.

Of the 70.6 hectares treated with AflaSafe™, 95%, belonging to 80 farmers, was under maize cultivation while the remaining 5%, owned by 6 farmers, was planted with groundnuts. Prior to treatment with AflaSafe™, soil samples were taken from the plots to measure the native population structure of *Aspergillus flavus*. Soil and grain samples were taken at harvest to determine the extent of changes in the *Aspergillus* community structure in favour of the applied biocontrol strains. For each treated field, an adjacent field where AflaSafe™ was not applied served as control to allow pair-wise comparison of the efficacy of the biocontrol technology. A total of 40 hectares was set aside for this purpose. The crops were

treated at various growth stages with different dosage rates to determine the optimal time and dosage for treatment. In almost all the fields, the atoxigenic strains began to sporulate on the carrier sorghum grains within three days after application.

In all the trials areas, presentations were made to the farmers on aflatoxin and its management, with special attention to biocontrol. Several extension officers were trained on how to treat farmers' fields with AflaSafe™ before they proceeded to their respective constituencies to carry out the exercise initially under the supervision of IITA staff. Officials from NAFDAC monitored the deployment of AflaSafe™ in one of the fields in Ogbomosho, harvesting in three fields in Kaduna State, and sample collection. The officials were satisfied with the procedures followed for the deployment of AflaSafe™.

Private sector partnership

AATF and partners appreciate the crucial role of the private sector in ensuring that the full benefits of AflaSafe™ are realised. On 14 July, IITA, USDA-ARS and AATF held a meeting with Nigeria's Federal Minister of Health, Prof Babatunde Osotimehin, to discuss the health and trade impact of aflatoxins and the need for its management. The partners presented the minister with a jointly-developed concept idea on the management of aflatoxin. Prof Osotimehin then asked for a project proposal for inter-ministerial consultation with the Agriculture Ministry. It was agreed that public-private partnerships for up-scaling AflaSafe™ would be one of the components of the proposal.

In addition, the Pampaida project has contacted three food and feed manufacturers in an effort to link farmers to the manufacturers. It is anticipated that the farmers will be able to sell their high quality product at a premium to the manufacturers.



Challenges

One of the key challenges that the partners faced in the process of deploying and testing the efficacy of AflaSafe™ was an underestimation of the time and effort required for preparing the dossier for registration. They also encountered lack of clarity in registration procedures since NAFDAC had not registered any biopesticide before AflaSafe™. Some of the protocols and documentation requirements for registration were therefore new to both NAFDAC officials and project partners. The partners were able to overcome these hitches by building a good relationship and rapport with various officials in NAFDAC through two workshops. The first was the Biopesticides Registration Training Workshop co-organised in 2008 with the USDA–Foreign Agriculture Service. The second was a stakeholders’ workshop in March 2009, where NAFDAC, project partners and other stakeholders discussed the potential of the biocontrol technology.

The demand from farmers to treat their fields with AflaSafe™ was way beyond the amount of inoculum that could be supplied from the lab-scale manufacturing process. In the Pampaida area alone, over 80 farmers wanted to treat their fields but the Pampaida Millennium Village project handling the deployment decided to restrict testing to 10 farmers and only five hectares.

Additionally, although the private sector has been supportive of the project, it is not clear if companies, except Nestlé, are willing to pay a premium for aflatoxin-safe maize and groundnut.

Next steps

In 2009, AflaSafe™ was supplied free of cost to the farmers who participated in testing its efficacy. It is not possible to continue supplying the technology free of cost in the future. It is therefore necessary to determine the

farmers’ willingness to pay for the product and so a business plan for AflaSafe™ is needed including commercial scale production of AflaSafe™.

NAFDAC has provided provisional registration of AflaSafe™ for a period of two years. During this period, on-farm data to demonstrate the efficacy of AflaSafe™ in reducing aflatoxin will be gathered and NAFDAC will monitor activities during the testing process. Therefore, a report on efficacy trials will be submitted to satisfy documentation requirements for full registration. Certification for the manufacturing facility will be sought from the Inspectorate Services of NAFDAC.

