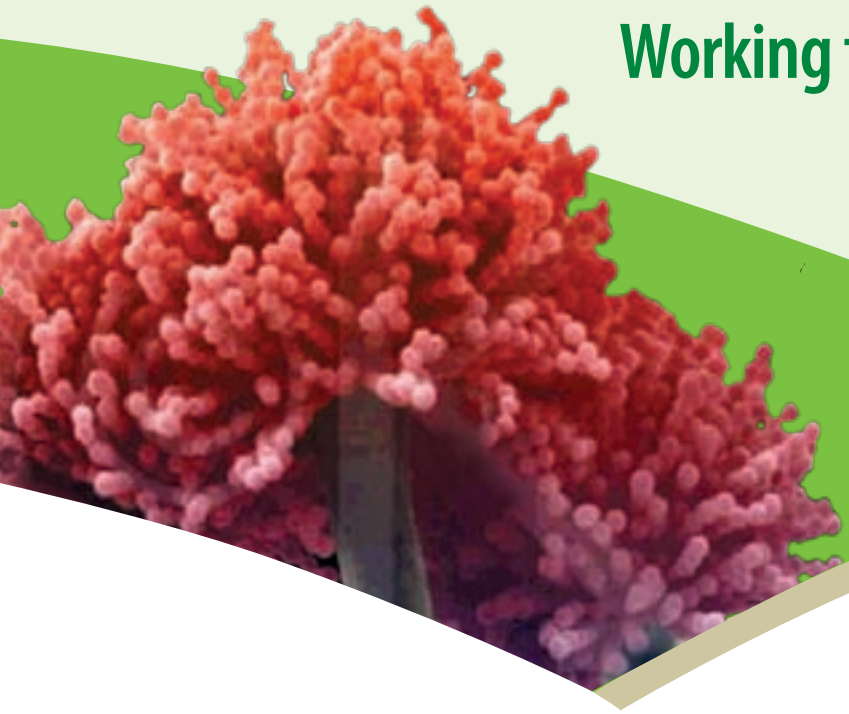
Controlling Aflatoxin:
Working to Avoid the Unavoidable



4.5 billion

more than 4.5 billion people living in the developing world may be chronically exposed to aflatoxins in their diets.

Aflatoxin is a highly toxic, carcinogenic poison produced by many species of Aspergillus*, a ubiquitous fungus that easily colonises maize, groundnut, and a number of other crops. New, cost-effective bio-control methods now being developed for Africa promise to dramatically reduce this threat to smallholder farmers and consumers across the continent.*

In general, contamination of food by aflatoxins occurs as a result of environmental conditions, especially hot and humid weather, as well as traditional farming methods, such as drying grain on the ground and improper storage practices. Commonly found in tropical climates, the aflatoxin-causing *Aspergillus* strains readily attack crops that are under stress, for instance from drought or insect infestation – the major food production constraints all too frequently encountered in Sub-Saharan Africa (SSA).

Not surprisingly, high levels of aflatoxins are found in food grains in many African countries, including Benin, Burkina Faso, Cameroon, Gambia, Ghana, Guinea, Kenya, Mozambique, Nigeria, Senegal, South Africa and Zambia. In these countries, major staple commodities and cash crops – maize, cassava, sorghum, yam, rice, groundnut and cashews among them – can be badly affected by these poisons. Because of its potentially severe health implications, aflatoxin contamination in food and animal feed can lead to major economic losses. For instance, African countries lose up to US$ 1.2 billion each year due to the rejection of commodities that fail to comply with food safety and quality owing to contamination by mycotoxins including aflatoxins.

Experts consider aflatoxins to be an unavoidable contaminant of food and feed even where good manufacturing practices have been followed. In developed countries stringent food safety regulations and monitoring of susceptible crops successfully limits their levels in the food supply. However, in many developing countries, Africa included, the situation is different. In these regions, governments often lack cost-effective ways to test for aflatoxins, and most smallholder farmers are unable to prevent contamination during the production and storage of their crops. As a result, more than 4.5 billion people living in the developing world may be chronically exposed to aflatoxins in their diets.

AATF is responding to the challenge posed by aflatoxins to the livelihoods and food security of African smallholders by facilitating the development and availability of microbial 'competitive exclusion technology' (CET). This approach can control aflatoxin production in important staple and cash crops.

It involves the establishment of benign strains of selected *Aspergillus* strains in the soils

around susceptible crops as they grow. The goal is for the benign strains to out-compete and largely eliminate the aflatoxin-producing strains of the fungus. This form of biological control – originally developed by the United States Department of Agriculture Agricultural Research Service (USDA-ARS) – has been tested extensively on cotton and peanuts in the USA with considerable success. The technology was subsequently licensed for commercialisation to a growers' organisation under the name of AF36, and to a private company that is marketing it under the name AflaGuard®. In 2005, AATF began negotiating with the company for access to the technology with the aim of adapting it to African conditions. Unfortunately, these negotiations have not progressed as anticipated, forcing AATF to take a different path.

In 2008, the Foundation began working with the International Institute of Tropical Agriculture (IITA) in Nigeria and with the USDA-ARS at the University of Arizona (USA) to develop alternative sources of competitive exclusion technology for use on maize and groundnuts in Africa. However, before investing significant resources in the development of the technology, the partners agreed that a study be carried out to evaluate the technical and commercial viability of using CET to control aflatoxin contamination in an African setting.

The study, which was commissioned by AATF, was completed in 2008 and reached the following general conclusions about the potential benefits of the new bio-control technologies:

- Controlling aflatoxin would contribute significantly to increased crop production, higher incomes, improved nutrition, and better health of people;
- There are clear indications that controlling aflatoxin would help to expand export markets for the affected commodities, especially for groundnuts, and therefore higher trade revenues for countries in Sub-Saharan Africa; and
- Analyses of the profitability potential of using new technologies, conducted under different effectiveness scenarios, indicate that investments in the research and dissemination of CET, even if only 20% effective, will be well placed.

In addition, recent research reinforces the technical viability of CET. Researchers from IITA and the USDA-ARS have developed microbial CET for reducing aflatoxin contamination in maize in Nigeria. They have also identified local benign strains of *Aspergillus* that are capable of overwhelming the toxin-producing strains, which in turn leads to a direct reduction in aflatoxin production in maize. In laboratory and on-station field trials, these competitive strains reduced aflatoxin contamination by 95% to 99%. In larger scale, on-station trials in four locations in Nigeria, aflatoxin production was reduced by 50% to 99%. Moreover, delivering the CET to the field is easy and effective, involving no more than broadcasting onto the soil an appropriate mixture of local benign strains of *Aspergillus*.

Based on this research and the encouraging results of the viability study, the project partners are planning to further evaluate the effectiveness of microbial CET in farmers' fields in Nigeria during 2009. The aim of this next round of testing is to determine the extent to which aflatoxin contamination of maize can be reduced under conditions that resemble real-life farming situations more closely. If these tests are as successful as anticipated, AATF will work with its partners to establish a fully-fledged project for the development and dissemination of locally adapted microbial CET for controlling aflatoxin in maize and groundnuts.

For more information, contact Hodeba J Mignouna (h.mignouna@aatf-africa.org)