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# AFLATOXIN CONTROL

## BACKGROUND AND KEY PRINCIPLES AS WE WORK TOWARDS A HOLISTIC APPROACH FOR AFLATOXIN CONTROL IN AFRICA

### 1. The Impact of Aflatoxins on Food Safety and Beyond

The Aflatoxin problem is a cross-cutting issue that is undermining public health and development efforts. Aflatoxins themselves are highly toxic, cancer causing fungal metabolites known to cause immune-system suppression, growth retardation, liver disease, and death in both humans and domestic animals. According to the United Nations Food and Agriculture Organization (FAO), 25% of world food crops are affected, and countries that are situated between 40°N and 40°S are most at risk. Over 5 billion people in developing countries are at risk of chronic aflatoxin exposure. Unless aflatoxin levels in crops and livestock are effectively managed, international development efforts to achieve greater agricultural development, food security and improve health will be undermined, particularly in sub-Saharan Africa where contamination is widespread and often acute. Inexpensive, traditional post-harvest practices can reduce the level of contamination, and a new aflatoxin management technology in the form of a local beneficial technology, derived from native African micro-flora, has been developed to fight aflatoxin in the soil, where it begins.

A broad range of stakeholders<sup>1</sup> are exploring the creation of an Africa-led partnership to develop a comprehensive strategy to control aflatoxin contamination, focusing on entire value chains in order to ensure a holistic and integrated approach for aflatoxin control. The goals of a Partnership for Aflatoxin Control in Africa (PACA) would be to reduce the incidence of aflatoxin in food, improve public health, increase trade, augment smallholder income, and enhance food security in Africa. A process is currently underway to interview stakeholders from all sectors of society and to convene a series of meetings to raise awareness and seek input on the array of programs and activities needed for aflatoxin control in Africa, including a PACA. We are currently planning for an aflatoxin discussion session that will be scheduled during the CAADP Partnership Platform meeting, 23-25 March 2011, in Cameroon.

### 2. Cross-Cutting Nature of the Aflatoxin Problem

#### a. Public Health

Because of its toxicity, aflatoxin contamination is both a food safety and public health issue. In high doses, aflatoxins can lead to serious illness like acute liver cirrhosis and death in both humans and animals. Chronic sub-lethal doses of aflatoxin are more insidious. Aflatoxin exposure is strongly linked to an increased risk of liver cancer with the rate of liver cancer reported to be up to 60 times higher in the aflatoxin hotspots of Mozambique than in the USA. Two independent studies have linked aflatoxin to immune suppression, increased susceptibility to diseases (e.g. HIV and malaria), and possibly compromised vaccine efficacy. With aflatoxin seriously affecting maize production, aflatoxin exposure poses the greatest health risk to populations who rely on maize as their main staple.

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<sup>1</sup> These organizations include funders, government agencies, research institutions, companies, and NGOs. Examples include: the Bill & Melinda Gates Foundation, USAID, USDA, African Union, COMESA, and The World Bank.

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Limited recent studies show association of aflatoxin exposure and stunted growth in children under 5 years old. These are preliminary findings that need further investigation, but based on studies in Togo and Benin, large numbers of children may be affected by aflatoxin-associated stunting, potentially contributing to a significant public health burden in developing countries

## **b. Trade and Economic Development**

Aflatoxin contributes to significant nutritional and economic losses in major commodities such as groundnuts, maize, sorghum, cassava, yam chips, cotton seeds, coffee, cocoa, copra, and oils. Aflatoxin contamination prevents commodities from meeting international, regional and local regulations and standards governing agricultural trade and food safety, posing a major obstacle to many agricultural producers looking to participate in agricultural trade and local food procurement initiatives. Contaminated food is “lost” as it must be destroyed or used for alternative uses. Losing a percentage of a season’s harvest has significant economic consequences for the entire value chain, especially when agriculture accounts for the majority of economic activity in a country.

Small farmers are hit particularly hard. Governments and development experts are promoting local purchase from small farmers in order to meet food gaps in food deficit areas while providing a market for small farmers and boosting their incomes. The Gates Foundation has found that aflatoxin contamination is limiting our partners’ ability to purchase from small farmers, as contaminated crops do not meet the food safety standards partners are required to follow, undermining local purchase programs and other investments in seeds, tools and fertilizers intended to boost agricultural development and trade.

Beyond affecting crops and human health, aflatoxin contamination also impacts the production of healthy livestock through contaminated feed, causing a decrease in milk and egg yields, with high doses causing serious illness, which could have devastating economic impacts on the livestock and dairy sectors at a time when farmers are striving for higher yields.

## **c. Regulatory Environment**

Human exposure to aflatoxins is limited by regulations that prohibit the use of crops containing excess quantities of aflatoxins for foods and feeds. Aflatoxins are regulated in part per billion (ppb) ranges with the maximum allowable level varying by country and intended use of the commodity. For instance, the quantity permitted in U.S. foods ranges from 0.5 parts per billion (ppb) to 20 ppb. The E.U. has set the limit for aflatoxin in foods destined for human consumption at 2 ppb (aflatoxin B<sub>1</sub>) and 4 ppb (total aflatoxins). If aflatoxin levels, which are systematically tested in these countries, exceed the levels above, the food in question is not safe for human consumption and the commodities are required to be destroyed or designated for alternative uses (e.g., blending to reduce contamination levels, decontamination, various types of livestock feed). However, aflatoxin contamination is generally not appropriately controlled and regulated in developing countries unless the product is exported. As a result, millions of people living in sub-Saharan Africa are chronically exposed to high, unsafe levels of aflatoxins through diet, while farmers miss out on export opportunities since their production does not meet international food safety standards.

## **3. Developments in the Private and Public Sectors to Support Aflatoxin Control**

Aflatoxin contamination is a global problem attracting global actors. As the world strives to increase agricultural production and reduce losses, there is evolving interest in aflatoxin control. The

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commercial sector, governments, and donors are investing in several areas including development of cheaper diagnostics, bio-control solutions, and improved storage. Some of the relevant developments include the following.

- a. Studies on the impact of Aflatoxins on Health and Nutrition:** Raw data on the impact of aflatoxin in Africa is lacking. Partners are interested in additional studies. Most recently:
- IFPRI has undertaken a new aflatoxin data project that focused on groundnuts in Mali and maize in Kenya, examining the impact of aflatoxin. The project is collecting data on aflatoxin prevalence along maize and groundnut value chains, consumption, livelihood and behavioral indicators. With the data they are examining 1) the economic impact on livelihoods (health consequences, income, and trade), 2) developing a data base of aflatoxin prevalence as maize and groundnuts move through the value chain and how control measures alter that prevalence, 3) understanding value chain actors knowledge, attitude, perception and practices regarding aflatoxin control and understanding their willingness to pay for risk reduction strategies, 4) developing predictive risk maps, and 5) conducting a risk analysis (risk assessment and cost/benefit analysis) of control strategies.
  - The Bill & Melinda Gates Foundation intends to fund further research on the impact of aflatoxins on humans.
  - The World Bank is funding a two-year desk analysis of post-harvest grain losses with the Natural Resources Institute (NRI). Phase one, focusing on the overall estimation of grain losses in storage, is complete. A second phase will examine the specific causes of the losses to quantify aflatoxin's impact on post-harvest grain losses.
  - The World Bank is also funding an economic analysis to look at the development of tools to help prioritize investments in food safety, based on assessed health and economic risks. Aflatoxin will likely be included in the study.
  - With support from the McKnight Foundation, ICRISAT and NASFAM mapped aflatoxin contamination of groundnuts and groundnut products in Malawi and are currently working on post-harvest value chain improvements.
- b. Development of Natural aflatoxin control Technology:** Currently, aflatoxin contamination is prevented with a variety of tools such as post-harvest drying (where cost effective), storage, shelling, de-hulling, sorting, early harvest, regionally adjusted planting dates, and insect control. However, even where storage conditions are generally good, aflatoxins frequently form prior to harvest while the crop is maturing and/or awaiting harvest, which can result in significant losses. US producers of peanut, cotton, corn, and tree crops came together with USDA to work on resolving the aflatoxin problem over a decade ago. The outcome was a biological control technology which is currently the most effective aflatoxin prevention tool on the commercial market, and has been used successfully on three major commercial crops (corn, peanut, and cottonseed) in the U.S. African researchers are now working to adapt this low cost solution for African farmers to reduce aflatoxin contamination.

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- The International Institute of Tropical Agriculture (IITA), with the African Agricultural Technology Foundation (AATF) has completed research on strains for use in Nigeria. Trials on the resulting natural aflatoxin control product dubbed 'Aflasafe' have proven extremely effective and it is provisionally approved for on-farm use by Nigerian regulators. Field testing of biological control technology is nearly complete in Nigeria and beginning in Senegal. Efficacy trials in Nigeria have been demonstrated to reduce contamination in the field by up to 80%.
  - USDA, IITA, AATF and KARI, with funding from USDA, and building on work funded by GTZ and others, are currently adapting a new biological control technology to combat aflatoxin contamination in Kenya.
  - Recognizing that widespread adoption of Aflasafe by smallholders will require innovative financing and a commercially viable approach for manufacturing and distribution, selected donors, researchers, finance professionals and manufacturers met in London on October 8, 2010 for a "lab" facilitated by the Milken Institute. The Milken lab is exploring how best to design so-called pull mechanisms and the World Bank's Innovative Finance Team and the Government of Canada will further discuss the development of an innovative finance mechanism for aflatoxin control.
  - As part of the analysis of commercialization options for Aflasafe, Doreo Partners is working with IITA and the Gates Foundation on a demand and supply analysis that would be used to inform a possible franchising model for manufacturing Aflasafe, which would likely first be introduced in Nigeria.
- c. Development of affordable field test kits:** At present, diagnostics options to test for the presence and levels of aflatoxin contamination are expensive and generally involve off-site laboratories. Diagnostics for All will be developing less expensive, simple diagnostic test kits, using a new technology developed at Harvard University.

#### 4. Holistic Approach for Aflatoxin Control

Based on the Bill and Melinda Gates Foundation's focus on agricultural development and recognition of the threat aflatoxin poses to health and trade initiatives, the Foundation organized a meeting in June 2010 that was hosted by the U.S. Department of Agriculture in Washington, D.C. to discuss a comprehensive strategy to address issues related to aflatoxin contamination. As an outcome of this meeting, more than thirty stakeholders from governments, foundations, donors, research institutions, universities, companies and non-governmental organizations, committed themselves to working together on aflatoxin control, with many of them already working together on implementing existing solutions to the aflatoxin problem as mentioned above. These and other organizations have been engaged in ongoing conversations during interviews and at meetings. They are recommending that a holistic approach to aflatoxin control be developed with an aim to support implementation of cost-effective aflatoxin management practices and technology to improve public health, increase trade, augment smallholder income, and enhance food security in Africa.

Stakeholders are suggesting the creation of a Partnership for Aflatoxin Control in Africa (PACA) that is Africa-led and addresses African priorities. The PACA should be linked to existing processes and institutions, while ensuring engagement of the broad range of organizations with relevant expertise

and resources. And, and PACA should be set up to enable inter-disciplinary collaboration across the agriculture, food safety, nutrition, and health disciplines. A PACA might focus on the following activities:

**a. Facilitate Coordination on Cross-Cutting Issues**

- Enable cross-project activity knowledge capture, information sharing and coordination;
- Provide communications, information and education on aflatoxin issues through publications and regular updates;
- Create linkages to political processes, including Comprehensive Africa Agriculture Development Programme (CAADP);
- Link to organizations and initiatives focused on health, nutrition, and food safety aspects.

**b. Develop a Comprehensive Strategy Focused on Full Value Chain**

Develop a comprehensive strategy to address issues related to aflatoxin contamination, focusing on entire value chains to ensure sustainability. These strategies would include many, if not all, of the elements identified in the following graphic.



**c. Focus on Aflatoxin with Eventual Application to Other Mycotoxins**

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- Post-harvest best practices, improved diagnostics, and research breakthroughs can be extremely useful in mitigating other mycotoxins.
  - Similarly, technology developed for mitigating of other mycotoxins may be applied to aflatoxin.
  - A PACA needs to be broad enough to share information across the mycotoxin spectrum to ensure that improvements in yields, trade and public health are realized.

Although a PACA might focus on sub-Saharan Africa, its strategies and experiences might apply to other regions. A PACA might be expanded globally or replicated in other regions.

## **5. Next Steps**

To further the development of a holistic strategy for aflatoxin control, including an African Partnership for Aflatoxin Control, a discussion session is being planned for 23-25 March 2011 Comprehensive Africa Agriculture Development Programme (CAADP) Partnership Platform (PP) meeting. We believe that linking a comprehensive aflatoxin mitigation initiative to the CAADP framework provides the most appropriate forum to effectively align with and support African government priorities, integrate aflatoxin control activities, and efficiently share information across disciplines.

We look forward to working with the African Union and other African stakeholders to plan a 2-hour session during the CAADP PP meeting to discuss the following topics:

- Review aflatoxin contamination issues in Africa;
- Exchange information about aflatoxin management programs and activities;
- Define a potential structure for an Africa-based and Africa-led partnership.
- Determine next steps, following the CAADP PP meeting.