

# STRENGTHENING AFLATOXIN CONTROL IN TANZANIA: POLICY RECOMMENDATIONS

BASED ON FINDINGS OF THE  
COUNTRY-LED SITUATION ANALYSIS  
AND ACTION PLANNING (C-SAAP)  
CONDUCTED FROM 2014 TO 2016 BY  
THE PARTNERSHIP FOR AFLATOXIN  
CONTROL IN AFRICA (PACA)



Partnership  
for Aflatoxin  
Control in Africa

Partenariat pour  
lutter contre  
l'aflatoxine en Afrique

Parceria para o  
Controle da  
Aflatoxina em África

الشراكة من أجل مكافحة  
الافلاتوكسين في أفريقيا



## 1. WHAT ARE AFLATOXINS?

Aflatoxins are highly toxic metabolites that affect the safety of food and feed in tropical and subtropical regions of the world, including Tanzania. They are mainly produced by *Aspergillus flavus* and *Aspergillus parasiticus* fungi that reside in soil. There are four types of aflatoxins that are important in health and agriculture: aflatoxin B<sub>1</sub>, B<sub>2</sub>, G<sub>1</sub>, and G<sub>2</sub>. Aflatoxin B<sub>1</sub> is the most common of the four types.

## 2. WHAT ARE THE HEALTH EFFECTS OF AFLATOXINS?

The health effects of aflatoxins can be categorized into two general forms: acute and chronic aflatoxicosis. Acute aflatoxicosis results from ingestion of food containing moderate to high levels of aflatoxins and is characterized by a rapid and obvious onset of toxic responses, including hemorrhaging, acute liver damage, edema (swelling), digestive difficulties, and possibly death, usually within a week of exposure. Chronic aflatoxicosis is experienced when individuals ingest low levels of aflatoxins in food over a long time-period. This is associated with immune suppression, low birth weight, impaired child growth and liver cancer. The biggest and best known health effect of aflatoxin is liver cancer. It is estimated that globally about 782,200 new cases of liver cancer occur yearly, and that 83% (648,200) of them occur in less developed countries, including Africa<sup>1</sup>. According to Liu and Wu<sup>2</sup>, as high as 28.2% of the annual global liver cancer cases may be attributable to aflatoxin exposure and 40% of these cases occur in Africa, making liver cancer the top cause of cancer mortality in the continent. Aflatoxin B<sub>1</sub> is recognized by the International Agency for Research on Cancer of the World Health Organization (WHO) as one of the most toxic and carcinogenic substances found in nature.

## 3. WHAT ARE THE TRADE IMPACTS OF AFLATOXIN CONTAMINATION IN FOODS?

The Food and Agriculture Organization of the United Nations estimates that 25% of the food produced worldwide is contaminated with aflatoxins. Due to the increasing recognition of the impact of aflatoxins on human health, food regulatory authorities have set and enforced limits for aflatoxins in traded food. Stringent limits of 2 ppb for aflatoxin B<sub>1</sub> and 4ppb for total aflatoxins in foods are enforced in the European Union (EU). In countries that fail to meet aflatoxin standards, foreign income from aflatoxin prone foods falls as exporters cannot access strategically important

international markets. Africa is reported to have lost more than US\$ 670 million per year in export earnings due to the presence of aflatoxins in farm produce. If a country does not have or enforce aflatoxin regulations, contaminated foods which do not meet export standards will be sold in the domestic market or used for household consumption, increasing the health risks associated with aflatoxin exposure in local communities.

## 4. WHAT TYPES OF FOOD ARE PRONE TO AFLATOXIN CONTAMINATION?

*Aspergillus* spp. can colonize and contaminate a wide variety of food commodities with aflatoxins, including maize, rice and groundnuts, which are staple foods in Tanzania.

## 5. WHAT ARE THE GLOBAL REGIONS MOST AFFECTED BY THE AFLATOXIN CONTAMINATION PROBLEM?

Fungal growth and the formation of aflatoxins in food is influenced by climatic conditions. Regions and countries, such as Tanzania, located between 40°N and 40°S, have a climate that favors growth of the aflatoxin producing *Aspergillus* spp. and are thus chronically affected by aflatoxin contamination of food and feed.

## 6. AT WHAT STAGES ALONG THE FOOD CHAIN DOES AFLATOXIN CONTAMINATION OCCUR?

The risk of aflatoxin contamination begins during pre-harvest and can be worsened by inappropriate harvesting, handling, storage, processing, and transport practices. Droughts, high temperatures, low soil fertility, pest infestation and other stresses that affect plant growth and vigor increase the likelihood of fungal infection as well as the levels of aflatoxins produced by the *Aspergillus* fungi. Aflatoxin contamination can thus be prevented by application of good agricultural practices in crop cultivation and good management practices in post-harvest food handling.

## 7. TO WHAT EXTENT ARE TANZANIAN FOODS CONTAMINATED WITH AFLATOXINS?

Various studies have shown the high prevalence of aflatoxins in maize from different regions of Tanzania. The studies show that the risk of unsafe aflatoxin contamination in maize is highest in the Eastern zone (specifically, the Morogoro region) and Western zone (particularly, the Tabora and Geita regions). The prevalence of maize samples with levels of aflatoxins exceeding the national regulatory limits showed variation across regions of Tanzania (Table 1).

1 Ferlay, J., Soerjomataram, I., Dikshit, R., Eser, S., Mathers, C., Rebelo, M., Parkin, D., Forman, D. and Bray, F. 2015. Cancer incidence and mortality worldwide: sources, methods and major patterns in GLOBOCAN 2012. International Journal of Cancer 136(5): E359-E386. Doi:10.1002/ijc.29210.

2 Liu, Y. and Wu, F. 2010. Global burden of aflatoxin-induced hepatocellular carcinoma: a risk assessment. Environmental Health Perspectives 118(6): 818-824

**TABLE 1: PREVALENCE OF AFLATOXIN IN MAIZE SAMPLES ACROSS DIFFERENT ZONES/REGIONS OF TANZANIA<sup>3</sup>**

Zone sampled	Region (period) of sampling	Samples exceeding maximum limit of 5 ppb for aflatoxin B <sub>1</sub> (%)	Samples exceeding maximum limit of 10 ppb for total aflatoxins (%)
Eastern	Morogoro (2012)	43	43
	Morogoro (2015)	75	25
Northern	Kilimanjaro	3	7
	Manyara	9	9
Southern	Ruvuma	3	3
Southern Highlands	Iringa	3	7
	Rukwa, Mbeya and Iringa	4	2
Western	Tabora	34	30
	Geita	40	40

On the other hand, the risk of aflatoxin contamination in groundnut did not vary much from region to region. Abt Associates Inc. (2013)<sup>4</sup> reported that the levels of aflatoxin B<sub>1</sub> and the level of total aflatoxins exceeded the respective Tanzanian limits of 5 ppb and 10 ppb in 20% of the 20 groundnut samples from Manyara (Northern zone) and in 20% of the 40 samples from Mtwara (Southern zone). The investigation also found that the levels of aflatoxin B<sub>1</sub> and total aflatoxins exceeded the respective regulatory limits in 18% of the 40 samples of groundnuts from Geita (Western zone).

The risk of unacceptable levels of aflatoxins in rice appears low as none of samples analyzed in the C-SAAP work contained aflatoxins at levels exceeding the maximum national regulatory limits. The total aflatoxin levels in the 101 samples from the three main rice-producing districts of Tanzania, namely Kilosa (Morogoro in Easter zone), Mbarari (Mbeya in Southern Highland) zone and Misungwi (Shinyanga in Western zone), ranged from 0.01-3.83 ppb.

## 8. TO WHAT EXTENT ARE MAIZE, GROUNDNUT AND RICE IMPORTANT FOR FOOD SECURITY IN TANZANIA?

Maize is the staple food most consumed in Tanzania, with an average of 405 g/person/day consumed in rural areas and

<sup>3</sup> PACA. 2016. *Country-led Aflatoxin and Food Safety Situation Analysis and Action Planning for Tanzania: Final Report*, Partnership for Aflatoxin Control in Africa, African Union Commission

<sup>4</sup> Abt Associates Inc. 2013. *Country and Economic Assessment for Aflatoxin Contamination and Control in Tanzania*. Prepared for the Meridian Institute in support of Partnership for Aflatoxin Control in Africa (PACA)

297 g/person/day consumed in urban areas. Rice is the third most important staple, with an average of 57.4 g/person/day consumption in rural areas and 109.9 g/person/day in urban areas<sup>5</sup>. Groundnuts are also important in Tanzanian diets and they are promoted as an ingredient in weaning foods. According to Abt Associates Inc (2013) maize, rice and groundnuts together account for 52% of the calorie intake in Tanzania<sup>6</sup>

## 9. WHAT IS THE EXTENT OF AFLATOXIN EXPOSURE AMONG THE PEOPLE OF TANZANIA?

On the basis of a biomarker study by Shirima *et al.* (2015)<sup>7</sup>, aflatoxin exposure in infants and young children in Tanzania has been found to be as high as 10,926 ng/kg body weight (bw) per day. Over 80% of infants and young children in Tabora in Tanzania's Western zone, Iringa in the Southern Highland zone and Kilimanjaro in the Northern Highland zone had aflatoxins in their blood.

### 1. What is the risk of developing aflatoxin-induced liver cancer in Tanzania?

<sup>5</sup> Smith, L. and Subandoro, A. 2007. *Measuring food security using household expenditure surveys*. *Food Security in Practice Series*. Washington, DC: International Food Policy Research Institute

<sup>6</sup> Abt Associates Inc. 2013. *Country and Economic Assessment for Aflatoxin Contamination and Control in Tanzania*. Prepared for the Meridian Institute in support of Partnership for Aflatoxin Control in Africa (PACA)

<sup>7</sup> Shirima, C.P., Kimanya, M.E., Routledge, M.N., Srey, C., Kinabo, J.L., Humpf, H.U., Wild, C.P., Tu, Y.K. and Gong, Y.Y. 2015. A Prospective Study of Growth and Biomarkers of Exposure to Aflatoxin and Fumonisin During Early Childhood in Tanzania. *Environmental Health Perspectives* 123: 173



The risk of developing liver cancer (when individuals are exposed to aflatoxins) is 30 times higher in people exposed to the hepatitis B Virus (HBV) compared to those who are not. In Tanzania about 7.07% of the population is HBV positive<sup>8</sup>.

Assuming that the biomarker based exposure of 10,926 ng/kg bw/day represents the situation in the entire country and given that HBV is prevalent in 7.07% of the population, it was estimated that 4,825 new cases of aflatoxin-induced liver cancer occur each year. This figure was calculated based on Tanzania's population of 47,132,580 in 2014.

## 10. WHAT IS THE NUMBER OF HEALTHY LIFE YEARS LOST DUE TO AFLATOXIN-INDUCED LIVER CANCER IN TANZANIA?

With assumption that 95% of the liver cancer cases results to death within a year, it was estimated that the 4,825 aflatoxin-induced liver cancer cases, would lead to **a loss of 88,864 healthy life years, annually**. The healthy life years lost were estimated using the disability adjusted life years (DALYs) approach whereby DALYs per liver cancer case of 18.38 was used.

## 11. WHAT IS THE ECONOMIC IMPACT OF AFLATOXIN-INDUCED LIVER CANCER IN TANZANIA?

The annual economic impact caused by the 4,825 new aflatoxin-induced liver cancer cases is estimated to be as high as **US\$ 1,100 million**. This sum was calculated using the transferred value per statistical life (VSL) method.

## 12. WHAT ARE THE CURRENT INITIATIVES TO CONTROL AFLATOXINS IN TANZANIA?

### a. PACA supported initiatives

PACA supported a country-led situation analysis and action planning (C-SAAP) for aflatoxin control along the groundnut, rice and maize value chains in Tanzania. The policy recommendations in this document are based on the outcomes of the C-SAAP. Additionally, in partnership with key institutions in Tanzania, PACA is generating and sharing data under the framework of the Africa Aflatoxin Information Management System (AfricaAIMS) initiative. AfricaAIMS generates data on aflatoxin contamination in groundnut, rice and maize, as well as on other aflatoxin related issues in the health and trade sectors. The initiative's key objective is to provide locally relevant, home grown and reliable evidence to facilitate informed decisions on policies, food safety regulations and standards, mitigation interventions (e.g. educational and technological), resource allocation, and advocacy and awareness raising activities by the Tanzanian government and other stakeholders. Local capacity building, through the provision of equipment and training of

<sup>8</sup> Liu, Y. and Wu, F. 2010. Global burden of aflatoxin-induced hepatocellular carcinoma: a risk assessment. *Environmental Health Perspectives* 118: 818-824.

personnel, is central to AfricaAIMS.

PACA also provided catalytic support to develop a resource mobilization strategy and convene business meetings to enhance ownership and financing of the national aflatoxin control plan. PACA's catalytic support extends to convening aflatoxin working groups to spearhead planning and implementation of aflatoxin mitigation actions at the country level. In order to ensure that these efforts are well coordinated, PACA has hired a country officer who is hosted by the Tanzania Food and Drugs Authority (TFDA). PACA shall provide ongoing support to track progress in the implementation of the national aflatoxin control plan.

**b. Tanzania Initiative for Preventing Aflatoxin Contamination (TANIPAC)**

In March 2017, the Global Food Security Investment Program (GAFSIP) approved a grant of US\$ 20 million for implementation of TANIPAC. The proposal for this project was initiated and prepared with technical and financial support from PACA, and submitted to GAFSIP in January 2017 for consideration. The main objective of this project is to minimize aflatoxin occurrence in the food system through an integrated mitigation approach in the maize and groundnut value chains. The project will be implemented in 18 districts in six regions of mainland Tanzania and in Unguja and Pemba Islands in Zanzibar. The beneficiaries include 1 million farm households (30% of which are female headed households), 120 extension and technical staff, 2,000 traders and transporters, and 2,000 small and medium-sized enterprises involved in food processing. The project is expected to be launched in 2018, with the African Development Bank as supervising entity and PACA as technical advisor.

## 13. WHAT ARE THE ROLES OF KEY INSTITUTIONS INVOLVED IN THE DELIVERY OF FOOD SAFETY CONTROL SERVICES IN TANZANIA?

The C-SAAP review of policies and regulatory infrastructures revealed that, in Tanzania, food safety control services are delivered under the ministries responsible for agriculture, health and trade, but that there is a poor institutional framework for implementing the control measures. The roles of the key institutions are briefly presented below:

- a. **Ministry of Agriculture and Ministry of Livestock and Fisheries**  
Under the ministries responsible for agriculture, food safety activities are implemented and coordinated in accordance with the National Agricultural Policy of 2013.
- b. **Ministry of Industry, Trade and Investment**  
This ministry implements food safety control activities in accordance with the Agricultural Marketing Policy of 2008 and the Tanzania Standards Act of 2009.

- c. **Tanzania Bureau of Standards (TBS)**

In accordance with the Tanzania Standards Act (2009), the setting of food safety standards is mandated to TBS, under the ministry responsible for trade. TBS has already set MLs of 5 ppb for aflatoxin B1 and 10 ppb for total aflatoxins in foods for human consumption in Tanzania.

- d. **Ministry of Health, Community Development, Gender, Elderly and Children**

Food safety services under the ministry responsible for health are administered in accordance with the Tanzania Food, Drugs and Cosmetics Act of 2003.

- e. **Tanzania Food and Drugs Authority**

Using mainly the TBS formulated food standards, the TFDA, a body under the ministry responsible for health, registers food for local manufacture or importation and regularly inspects, tests, and certifies all foods sold for export. TFDA derives its powers from the Tanzania Food Drugs and Cosmetics Act (2003) and is regarded as the food safety coordination body for Tanzania.

## 14. WHAT IS THE LEVEL OF AWARENESS AND KNOWLEDGE OF AFLATOXINS AMONG TANZANIANS?

Aflatoxin knowledge and awareness in Tanzania is very low. About 80% of individuals interviewed in 2012 (Abt Associates Inc, 2013) were not aware of the aflatoxin problem. Additionally, even some public health professionals, such as nursing officers did not know what aflatoxins are. This finding calls for more focused studies of the knowledge of such caretakers to understand and address the gap in information about aflatoxins

## 15. EVIDENCE-BASED POLICY RECOMMENDATIONS FOR THE MITIGATION OF THE AFLATOXIN PROBLEM IN TANZANIA

Based on the gaps identified in aflatoxin control in Tanzania, a set of recommendations have been developed by the C-SAAP team and validated by stakeholders. The recommendations were designed to cover the whole food value chain, from farm to table, and are outlined in Table 2. They are aimed at enabling farmers, traders, processors, policymakers and consumers to prevent aflatoxin contamination in food; enhance research and knowledge of aflatoxin prevention strategies; raise awareness of aflatoxin-related impacts; improve systems for the regulation of aflatoxins in food; and enable consumers to minimize their risk of aflatoxin exposure and the consequent effects.

**TABLE 2: STRATEGIC RECOMMENDATIONS FOR MITIGATION OF THE AFLATOXIN CHALLENGE IN TANZANIA<sup>9</sup>**

### Advocacy and awareness raising

1. Incorporate aflatoxin related risks into the curriculum taught at primary and secondary schools, as well as higher education institutions
2. Improve knowledge of processors, traders and producers on quality control and assurance with respect to aflatoxin contamination
3. Improve knowledge of health practitioners (doctors, nurses and laboratory technologists) on how to test for aflatoxin exposure to encourage early testing and referral of at risk patients
4. Advocate the links between aflatoxin exposure, HBV and liver cancer so that the ministry responsible for health integrates appropriate interventions
5. Develop a strategy for communication of the aflatoxin problem and mitigation measures
6. Conduct advocacy campaigns for policy makers and public decision makers each year
7. Organize continuous programs for raising public awareness about aflatoxins
8. Support the organization of an annual scientific forum for sharing aflatoxin information at a national level
9. Develop information and communication materials on dietary diversification
10. Advocate and sensitize private sector stakeholders to facilitate the establishment of a self-regulatory mechanism

### Farm level operations

11. Conduct trials and risk assessments for the identification and formulation of bio-control technologies for maize and groundnuts
12. Integrate aflatoxin control measures in good agriculture practices for all cereal and oil seed crops as well as in good animal husbandry practices
13. Establish model storage facilities for major agro-ecological zones
14. Support breeding of aflatoxin resistant maize and groundnut varieties
15. Improve district extension workers' capacity to train farmers in management of aflatoxins

### Transportation and processor interventions

16. Develop market-based incentives for production of safer food
17. Help cooperatives to enable processors and traders to acquire improved produce handling technologies

<sup>9</sup> Based on findings of the C-SAAP (PACA. 2016. *Country-led Aflatoxin and Food Safety Situation Analysis and Action Planning for Tanzania: Final Report*, PACA, African Union Commission)

## Policy improvement

6. Incorporate aflatoxin mitigation measures in the national Guidelines on Infant and Young Child Nutrition

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7. Formulate a Food Safety and Quality Policy in which the administration of risk assessments is clearly separated from risk management

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8. Transform the TFDA into an autonomous body, with a multi-sectoral food safety board, mandated to coordinate food safety from farm to fork

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9. Improve regulation and procedures for withdrawal of products exceeding aflatoxin MLs

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10. Pilot innovative systems for regulatory enforcement of aflatoxin control measures in the domestic market

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11. Formulate strategies for the implementation of food safety related policy statements of the National Agriculture Policy (2013)

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12. Develop strategies for the implementation of food safety related policy statements of the national Agricultural Marketing Policy (2008)

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13. Develop application guidelines for the Good Manufacturing Practices (GMP) and Hazard Analysis Critical Control Point (HACCP) approach to control aflatoxins in the manufacture of cereal and oil seed based food and feed

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14. Determine at least two crops that can be used to substitute for maize and groundnuts each year and incorporate them into national nutrition guidelines

## Institutional capacity building

18. Set a mechanism for resource mobilization for aflatoxin control

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19. Employ experts in aflatoxin issues in the TFDA, the TBS and the Ministry of Agriculture, Livestock and Fisheries

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20. Establish the capacity to monitor aflatoxin exposure in humans

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21. Develop the capacity for evaluation and monitoring of the effectiveness and efficacy of bio-control products

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22. Establish aflatoxin screening capacity in at least two zonal offices of the TFDA

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23. Support research for alternative uses of aflatoxin contaminated produce

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24. Build capacity of all district nutrition officers to tackle aflatoxin issues and limit aflatoxin exposure in infant and child nutrition

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25. Build capacity for regulation and monitoring of aflatoxins in animal feeds

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26. Provide a short annual course on aflatoxin management for personnel from each of the key sectors: health, agriculture and trade



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Visit [www.aflatoxinpartnership.org](http://www.aflatoxinpartnership.org)  
or contact [paca@africa-union.org](mailto:paca@africa-union.org)