FOOD SAFETY COALITION UGANDA

AFLATOXINS IN UGANDA:

HEALTH AND ECONOMIC IMPACTS, POLICY GAPS, AND STRATEGIC INTERVENTIONS FOR SUSTAINABLE FOOD SAFETY

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Executive Summary

Food safety in Uganda remains a critical public health and economic concern, with foodborne diseases affecting an estimated 1.3 million people annually (MoH, 2021). Hazards in the food supply chain are multifaceted, encompassing biological, chemical, and physical threats. Among these, aflatoxins, naturally occurring toxins produced by the fungus Aspergillus flavus, present a particularly complex and persistent challenge.

Food Safety Hazards and Gaps

Uganda's food system is vulnerable to contamination at multiple points, from production to consumption. Biological hazards such as pathogenic bacteria, viruses, and fungi; physical contaminants like foreign objects and pests, and chemical hazards including pesticide residues and heavy metals, all compromise food safety (FAO, 2024; SafeFood3600, 2024; Bamuwamye et al., 2017). Gaps persist in regulatory enforcement, capacity for surveillance, and public awareness, exacerbated by inadequate infrastructure and traditional food handling practices (FoSCU, 2024).

Aflatoxins: Nature, Health, and Economic Impact

Aflatoxins are potent carcinogenic mycotoxins that contaminate a wide range of Ugandan staples such as maize, groundnuts, and sorghum, among others, especially under humid, poorly controlled storage conditions (WHO, 2023; MAAIF, 2019). These toxins are highly stable, resistant to conventional cooking, and can enter the human food chain via animal products and even breastmilk (Kumar et al., 2017; Atukwase, 2024).

Acute exposure to high aflatoxin levels can cause rapid liver failure, digestive complications, and death, while chronic exposure is strongly linked to liver cancer and other long-term health effects (NIH, 2021; Zitomer, 2020; Kanga, 2015). The health burden translates into significant economic costs, with Uganda spending approximately US$910,000 annually on aflatoxin-related health services and facing potential economic losses of up to US$577 million per year due to trade restrictions and reduced productivity (Stinson, 2018; PACA, 2017).

Ongoing Efforts and Remaining Gaps

Uganda has initiated several interventions, including stakeholder coalitions (FoSCU), regulatory frameworks, and public awareness campaigns. However, enforcement remains weak, investments in innovative control measures are limited, and technical capacity is insufficient (AEC, 2023). Traditional farming methods, poor drying, and storage methods continue to drive widespread contamination, and counterfeit agrochemicals further complicate mitigation efforts (FoSCU, 2024; Juliet, 2018; Ariong, 2023).

Recommendations

To address the aflatoxin burden and broader food safety challenges, the following actions are recommended:

- Strengthen Regulatory Enforcement: Enhance monitoring and enforcement of food safety standards, particularly for aflatoxins and chemical residues.
- Invest in Infrastructure and Innovation: Support the adoption of improved drying, storage, and handling technologies at the farm and market levels.
- Capacity Building and Training: Expand technical training for farmers, traders, and regulators on best practices for food safety and aflatoxin control.
- Public Awareness: Intensify education campaigns to inform all stakeholders, producers, handlers, and consumers about the risks of aflatoxins and safe food practices.
- Research and Surveillance: Increase investment in research to develop context-appropriate interventions and strengthen national surveillance systems for foodborne hazards.
- Multi-sectoral Collaboration: Foster partnerships across government, academia, civil society, and the private sector to ensure coordinated, sustainable action.

By addressing these gaps through evidence-based, collaborative, and sustained interventions, Uganda can significantly reduce the health and economic impacts of aflatoxins, improve food safety, and enhance the resilience of its food systems.

Why This Report?

This report is critically important because it addresses one of Uganda's most persistent and under-recognized public health and economic threats: aflatoxin contamination in the food supply. With approximately 1.3 million Ugandans affected by foodborne illnesses each year (MoH, 2021) and with up to 75% of staple grains contaminated by aflatoxins (MTIC, 2015), the stakes for consumer health, food security, and national economic well-being are exceptionally high. Aflatoxins not only cause acute and chronic health conditions, including liver failure and cancer (NIH, 2021; Kanga, 2015) but also undermine agricultural productivity, restrict access to lucrative export markets, and impose significant costs on the healthcare system (Stinson, 2018; PACA, 2017).

This report provides a comprehensive, evidence-based analysis of the sources, impacts, and current gaps in Uganda's food safety landscape, with a special focus on aflatoxins. It brings together the latest research, policy analysis, and practical recommendations from leading experts, practitioners, and stakeholders in the field. By highlighting both the scale of the problem and the limitations of current interventions, the report serves as a vital resource for policymakers, development partners, private sector actors, and civil society. It offers actionable insights and strategic guidance to drive systemic improvements, protect public health, and strengthen Uganda's position in regional and global food systems.

Therefore, reading this report is essential for anyone committed to promoting safe food, advancing public health, and supporting sustainable economic development in Uganda. The findings and recommendations herein are designed to catalyze coordinated action, foster innovation, and ensure that all Ugandans have access to food that is not only plentiful but truly safe.

Methodology

This report was developed using a comprehensive desk review approach, ensuring that all findings and recommendations are grounded in the most current and credible evidence available. We systematically collected and analyzed published scientific papers, relevant technical reports, policy and regulatory documents from government Ministries, Departments, and Agencies (MDAs), as well as reports from United Nations agencies, policy briefs, and other authoritative sources from civil society organizations. This broad spectrum of materials provided a robust foundation for understanding the complexities of food safety and aflatoxin challenges in Uganda.

To guarantee the reliability and relevance of the information, our team accessed resources through reputable academic databases such as Google Scholar, PubMed, and ResearchGate. We also utilized official websites of MDAs, UN agencies (including FAO and WHO), civil society organizations, and other recognized platforms. Additionally, we drew on data and insights from credible global dashboards and repositories, particularly those maintained by FAO and WHO, to ensure our analysis reflected both national and international perspectives.

By employing this rigorous desk review methodology, we were able to synthesize diverse sources of evidence into a coherent and comprehensive analysis. This approach not only ensured integrity and objectivity but also provided a holistic view of the current food safety landscape, the aflatoxin burden, and the effectiveness of ongoing interventions in Uganda.

About Food Safety Coalition of Uganda

Established in 2023, the Food Safety Coalition of Uganda (FoSCU) strategically convenes a diverse network of Civil Society Organizations, academic institutions, Private Sector players, and expert practitioners to collectively address Uganda's critical need for sustainable access to safe food. Positioned as a multi-stakeholder platform, FoSCU leverages collaborative partnerships to drive systemic improvements in food safety through integrated research, capacity development, knowledge exchange, and policy engagement.

FoSCU's vision, ***"A society where all people sustainably access safe food,"*** and mission, "***to harness partnerships for promoting sustainable food safety for all consumers in Uganda and beyond,"*** reflect a commitment to inclusive, evidence-driven interventions that align with national and international food security and nutrition frameworks. The coalition's guiding principle, "***Safe food for all by all,"*** underscores its philosophy of a shared responsibility and collective action.

Operationally, FoSCU implements its mandate through four specialized technical working groups focused on research and development, communication and awareness, capacity building, and governance and compliance. Each group functions under a long-term strategic framework, ensuring targeted, coherent, and measurable impact across Uganda's food systems.

By integrating scientific rigor, stakeholder engagement, and policy advocacy, FoSCU positions itself as a pivotal actor in Uganda's food safety landscape, complementing national strategies and international initiatives aimed at transforming food systems for improved public health, economic resilience, and sustainable development.

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Acronyms

AEW	Agricultural Extension Workers
ATWG	Aflatoxin Technical Working Group
AU	African Union
C-SAAP	Country-Led Situational Analysis and Action Planning
EAC	East African Community
FAO	Food and Agriculture Organization
FONUS	Food and Nutrition Solutions
FoSCU	Food Safety Coalition of Uganda
IEC	Information, Education, and Communication
IITA	International Institute of Tropical Agriculture
MAAIF	Ministry of Agriculture, Animal Industry and Fisheries
MTIC	Ministry of Trade, industry, and cooperatives
NARO	National Agricultural Research Organization
NDP	National Development Plan
NTWGA	National Technical Working Group on Aflatoxins
PACA	Partnership for Aflatoxin Control in Africa
TGCU	The Grain Council of Uganda
UMMSC	Uganda Mycotoxins Mitigation Steering Committee
UNBS	Uganda National Bureau of standards
Ppb	Parts per Billion
SDG	Sustainable Development Goals
WHO	World Health Organization

CHAPTER 01 Introduction to Food Safety and Classification of Food Hazards

1.1 Introduction to Food Safety

Food safety encompasses a science-based framework and set of practices aimed at ensuring that food is handled, processed, distributed, and prepared in ways that minimize the risk of spoilage, contamination, and the transmission of hazards to consumers. The ultimate goal of food safety is to prevent foodborne illnesses and protect public health by eliminating or controlling biological, chemical, and physical hazards that may be present in food.

Globally, foodborne diseases represent a significant public health challenge. According to the World Health Organization (WHO, 2024), approximately one in ten people worldwide fall ill each year due to consuming contaminated food. This results in an estimated 420,000 deaths annually and a loss of 33 million Disability Adjusted Life Years (DALYs), underscoring the profound impact on global health and wellbeing.

In Uganda, the burden of foodborne illnesses remains substantial. The Ministry of Health (MoH, 2021) reported that approximately 1.3 million individuals experienced foodborne diseases in 2021, highlighting the urgent need for effective food safety interventions within the country's food supply chain.

Ensuring food safety throughout the entire supply chain, from production and processing to distribution and preparation, is essential to safeguarding consumer health. Effective food safety measures not only reduce the incidence of foodborne diseases but also contribute to improved nutritional outcomes, economic benefits through reduced healthcare costs and food loss, and the disruption of the cyclical nature of disease transmission.

1.2 Food Safety Hazards

Food contamination can arise from a variety of sources throughout the food supply chain, including air, water, soil, equipment, improper storage conditions, inadequate production and handling practices, and inappropriate temperature control (FAO, 2024). These contamination pathways introduce hazards that compromise food safety and pose significant risks to human health.

Food safety hazards are broadly classified into three categories: **biological, chemical, and physical.** These hazards refer to any biological organisms or substances, chemical compounds, or physical objects that may render food unsafe for consumption (United States Department of Agriculture Food Safety and Inspection Service, 2023).

1.2.1 Biological Food Hazards

These are among the most common and impactful contributors to foodborne illnesses. They include pathogenic bacteria such as *Escherichia coli, Staphylococcus aureus, and Salmonella Typhi*; fungi like *Aspergillus flavus;* and viruses including Hepatitis A and E, Rotavirus, and Norovirus, among others. These microorganisms are responsible for a wide range of illnesses, often causing symptoms such as diarrhea, vomiting, and fever, which can sometimes lead to severe health complications.

The human toll of these hazards is evident in Uganda, where approximately 1.3 million people were diagnosed with foodborne illnesses in 2021 alone (Daily Monitor, 2021). Common diseases such as typhoid, diarrhoea, brucellosis, dysentery, and cholera accounted for about 14% of all reported illnesses treated in the country that year. These statistics highlight the critical need for improved food safety measures to protect communities from preventable suffering and loss.

1.2.2 Physical Food Hazards

Physical hazards in food refer to visible foreign objects or materials that are aesthetically unpleasant and undesirable, which may inadvertently contaminate food products. Common examples include broken glass, metal fragments, plastics, stones, sand, paper, pits, wood, hair, animal droppings, as well as insects, both dead and alive, and their parts (SafeFood3600, 2024). These contaminants pose serious risks to consumers, as their ingestion can lead to injuries such as choking, cuts, or broken teeth, thereby compromising both food safety and consumer well-being.

In the context of Uganda's agricultural sector, physical hazards extend beyond general contamination to include quarantine pests such as caterpillars, fruit flies, and the Mediterranean fruit fly. The presence of these insects and their parts in agricultural produce has been documented and presents significant challenges for the country's participation in international trade. Specifically, these pests contribute to the failure of Ugandan produce to meet stringent food safety and quality standards required by global markets, particularly under sanitary and phytosanitary (SPS) measures established by the World Trade Organization (WTO, 2018).

Addressing physical hazards requires vigilant monitoring and control measures throughout the food supply chain from farm to fork to protect consumers from harm and to enhance the competitiveness of agricultural exports. By improving detection, prevention, and management of such hazards, Uganda can safeguard public health and strengthen its position in international markets.

1.2.3 Chemical Food Hazards

Chemical hazards in food arise from a variety of sources including veterinary drugs, food additives, pesticides, industrial chemicals, environmental pollutants, and natural toxins. These contaminants pose significant risks to human health, especially when present in concentrations exceeding established safety limits.

In Uganda, concerns about chemical food hazards have intensified due to evidence of widespread contamination across multiple food supply chains. Notably, chemical residues from crop protection products have been detected at levels surpassing international standards. For example, scientific studies have reported high residues of dithiocarbamates in tomatoes, exceeding the Codex Alimentarius maximum residue limits (Atuhaire et al., 2017). Similarly, antimicrobial residues such as tetracyclines and beta-lactams have been found in cattle carcasses, raising concerns about antibiotic resistance and food safety (Basulira et al., 2019). Additionally, heavy metals including lead, arsenic, cadmium, and mercury have been detected in vegetables and animal products, posing carcinogenic and organ toxicity risks to consumers (Kasozi et al., 2018; Bamuwamye et al., 2017).

The pervasive use and misuse of hazardous pesticides remain a critical challenge. Despite bans on many highly hazardous pesticides (HHPs) in other regions, such as the European Union, these chemicals continue to be used in Uganda's agriculture sector, often without adequate regulation or farmer training (FoSCU,2024). The presence of counterfeit agrochemicals, which constitute approximately 40% of Uganda's pesticide market, exacerbates the problem by increasing the likelihood of unsafe residues in food products. Such chemical contaminants have been linked to acute and chronic health effects, including cancer, reproductive toxicity, neurological disorders, and endocrine disruption.

Moreover, unsafe practices such as the use of toxic chemicals like formaldehyde to preserve meat and fish have been documented in urban markets, further endangering consumer health. These practices highlight gaps in the enforcement of food safety regulations and underscore the urgent need for strengthened surveillance and public awareness.

Therefore, chemical contamination of food in Uganda represents a multifaceted public health threat that requires coordinated action involving regulatory authorities, farmers, food handlers, and consumers. Strengthening monitoring systems, enforcing safety standards, promoting agroecological approaches, and educating stakeholders are essential steps toward reducing chemical hazards and ensuring safer food for Ugandans.

In conclusion, a clear understanding of the various sources and types of food safety hazards is fundamental to designing effective strategies that protect public health. By systematically addressing contamination risks at each stage of the food supply chain from initial production and processing through distribution and final preparation we can significantly reduce the incidence of foodborne illnesses. This comprehensive approach not only helps ensure the safety and quality of our food but also supports the wellbeing of consumers and the sustainability of food systems worldwide.

CHAPTER 02 Aflatoxins: Health Implications, Economic Impact, and Current Mitigation Strategies

2.1. Overview of the Aflatoxin Burden

Aflatoxins are toxic substances produced by the fungus *Aspergillus flavus*, which grows on foods that are moist and improperly stored or handled (WHO, 2023). In Uganda, many staple dried foods such as maize, sorghum, millet, cassava, sweet potatoes, groundnuts, soybeans, spices and fish are particularly vulnerable to contamination by aflatoxins (MAAIF, 2019). Animal feeds can also be contaminated with these aflatoxins and, if an animal eats these feeds, the toxins can end up into milk, meat and eggs. Also, if a lactating mother eats aflatoxin-contaminated foods, the toxins can end up into breastmilk, poisoning the infant. The widespread presence of aflatoxins in the foods and feeds is largely influenced by Uganda's climate. Conditions such as heavy rainfall, sudden droughts, high humidity, average temperatures around 25°C, and occasional flooding create an environment that promotes rapid growth and reproduction of the fungus, thereby increasing the risk of aflatoxin contamination (Atukwase, 2024).

Aflatoxin contamination can occur at multiple points along the food value chain, including preharvest, harvest, and postharvest stages, primarily due to improper handling by various actors involved (Atukwase, 2024). In Uganda, the reliance on traditional farming methods and basic technologies significantly increases the risk of aflatoxin contamination. For example, farmers often leave crops to dry in the field, exposing them to deterioration before harvest. During open-sun drying, produce is frequently placed directly on bare ground, tarmac roads, or rusted iron sheets, which not only heightens the risk of aflatoxin contamination but also exposes the crops to physical and biological contaminants (Juliet, 2018). Furthermore, many farmers fail to dry their produce to the recommended safe storage moisture levels due to inadequate storage facilities. Poor storage practices, such as heaping produce on the floor, storing it in unprotected granaries, or placing bagged produce directly on the ground, further increase vulnerability to moisture ingress and aflatoxin development (Ariong, 2023).

Traders including transporters, wholesalers, and retailers in Uganda often lack adequate food handling and processing facilities. Additionally, they sometimes utilize raw materials that are already contaminated with aflatoxins, which results in their products also containing these toxins (Ran Xu, 2022; Akullo, 2023). Numerous studies have documented aflatoxin levels in commonly consumed foods in Uganda that exceed the safety limits established for human and animal consumption (Gourd, 2023; Atukwase, 2024; Akullo, 2023). Importantly, research has shown that aflatoxins are highly stable and cannot be effectively destroyed by conventional cooking methods, as they tolerate high temperatures up to 420°C (Kumar et al., 2017; MAAIF, 2019).

Aflatoxins have been shown to negatively impact animal productivity, human and animal health, as well as trade and socio-economic development (Hoffmann & Herrman, 2018). In Uganda, the prevention and management of aflatoxin contamination face significant challenges, including weak enforcement of legal and regulatory frameworks, insufficient investment in innovative control measures, limited technical capacity, and low public awareness about these toxins (AEC, 2023).

2.2. Why Worry About Aflatoxins?

According to records from the Ministry of Trade, Industry and Cooperatives (MTIC), approximately 75% of grains in Uganda are contaminated with aflatoxins, with an average concentration of about 21 parts per billion (ppb) (MTIC, 2015). Research has shown that consuming high levels of aflatoxins poses serious health risks to both humans and animals. Additionally, the negative effects of aflatoxins on trade and socio-economic development in Uganda have been well documented. This section reviews the existing evidence on how aflatoxins impact public health and the country's economy.

2.2.1. Impact of Aflatoxins on Human and Animal Health

Aflatoxins are carcinogenic mycotoxins known to pose significant health risks to humans and animals (NIH, 2021). Acute exposure to high levels of aflatoxins has been identified as a potential risk factor for liver failure, characterized by the rapid onset of toxic reactions, including digestive complications, acute liver damage, hemorrhaging, edema, and in severe cases, death (Zitomer, 2020; Atukwase, 2024). Chronic exposure to lower levels of aflatoxins, on the other hand, has been strongly linked to an increased risk of liver cancer in humans (Kanga, 2015).

In Uganda, the health burden of aflatoxin-related illnesses imposes a considerable financial strain on the government. It is estimated that approximately US$910,000 is spent annually on health services to address aflatoxin-induced conditions, including increased demand for medical supplies and specialized care at public health facilities (Stinson, 2018). The Country-led Situation Analysis and Action Planning (C-SAAP) study conducted by the Partnership for Aflatoxin Control in Africa (PACA) between 2014 and 2017 further estimated that Uganda could lose up to US$577 million annually due to aflatoxin-related liver cancer cases (PACA, 2018). This study also reported that Uganda experiences around 3,700 new cases of aflatoxin-induced liver cancer each year, resulting in a loss of approximately 269,198 healthy life years.

Beyond liver disease, aflatoxins have been shown to adversely affect child health. Research by Atukwase et al. (2024) indicates that aflatoxin exposure suppresses the immune system and impedes growth in infants and young children, increasing their vulnerability to stunting, kwashiorkor, and exacerbating the severity of other infections.

Animal health is similarly compromised by aflatoxin contamination. Consumption of aflatoxin-contaminated feeds has been associated with increased mortality rates, reduced livestock productivity, higher veterinary costs, and challenges in safely disposing of contaminated feed materials (Nakavuma, 2020). Moreover, mould-infested feeds exhibit poor nutritional quality and undesirable sensory properties, which negatively impact feed intake among animals (Ran Xu, 2022). Importantly, humans consuming animal products contaminated with aflatoxins are also at risk of experiencing both acute and chronic health effects related to aflatoxin exposure (Raduly, 2020).

2.2.2. Impact of Aflatoxins on the Country's Economy

Between 2019 and 2022, Uganda experienced a decline in the export of key staple crops such as maize, sorghum, and groundnuts. Specifically, foreign exchange earnings from maize exports decreased from an annual average of US$101 million during 2012/13–2016/17 to US$96 million

in the period 2017/18–2021/22. This reduction has been largely attributed to concerns over poor product quality and safety, particularly high levels of aflatoxin contamination reported by neighboring countries (FONUS, 2023). For example, in March 2021, Kenya imposed a ban on maize imports from Uganda due to aflatoxin contamination (Mufumba, 2021). Similarly, in June 2023, over 62 trucks carrying maize flour from Uganda were denied entry into South Sudan for the same reason (Jolly, 2021).

A recent study by Food and Nutrition Solutions (FONUS, 2023) assessed the economic impact of aflatoxin contamination on Uganda's economy. The study found that contamination in maize, sorghum, and groundnuts, along with increased government and household health expenditures, reduced economic growth and employment by 0.147% and 0.107%, respectively, for the financial year 2023/24. Additionally, aflatoxin-related export rejections negatively affected tax revenue, with the government anticipating a loss of approximately US$9.2 million in tax collections between 2023/24 and 2026/27. The study also revealed that aflatoxin contamination decreased trade and transport margins by 0.035% for the domestic market and 0.345% for export markets, which in turn slowed business activities (FONUS, 2023). Furthermore, the combined effect of exchange rate appreciation and export rejections contributed to a 0.51% decline in real exports, equivalent to a loss of US$28 million in the 2023/24 fiscal year.

As aflatoxin regulations become more stringent, several East African Community (EAC) member states, including Rwanda, Tanzania, and the Democratic Republic of Congo, which previously imported dried produce especially grains from Uganda, have significantly reduced their import volumes (Kakuru, 2022). According to the Food and Agriculture Organization (FAO, 2023), Uganda's exports of maize, sorghum, and groundnuts to global markets have also declined substantially since 2016, primarily due to failure to meet aflatoxin standards in target markets. Collectively, these factors have adversely affected the economic growth and development of individuals, households, and the nation as a whole.

In light of the significant health, trade, and socio-economic impacts of aflatoxins in Uganda, it is imperative to prioritize comprehensive community awareness programs, strengthen capacity building, and increase investment in research and innovative solutions. Furthermore, robust enforcement of existing legal and regulatory frameworks is essential. Effective mitigation and control of aflatoxin contamination require coordinated and sustained collaboration among government agencies, academic institutions, the private sector, and civil society organizations to safeguard public health and promote sustainable economic development.

2.3. Uganda's Efforts in Addressing the Aflatoxin Burden

Uganda has initiated and participated in several initiatives and campaigns aimed at addressing the challenges posed by aflatoxin contamination. These efforts encompass, among others, legal, regulatory, and institutional measures, as outlined below;

- **Enactment of the Uganda National Bureau of Standards (UNBS) Act, 1983**

The Uganda National Bureau of Standards Act of 1983 established the Uganda National Bureau of Standards (UNBS) with the mandate to develop, review, modify, promote, and enforce national standards and specifications for commodities and codes of practice across the country (UNBS Act, 1983). Under this legislation, UNBS is also authorized to adopt or endorse international standards,

with or without modifications, to suit Uganda's context. This authority facilitates the harmonization of standards, thereby promoting both domestic and international trade.

Aflatoxin control and regulation in food products have been identified as key priorities within UNBS's mandate. To support safe trade, UNBS provides aflatoxin testing services and inspects food commodities both within and at the country's border to ensure compliance with the maximum allowable limits, which are set at 10 parts per billion (ppb) for total aflatoxins and 5 ppb for aflatoxin B1 specifically.

In line with this mandate, UNBS has developed specific aflatoxin standards for several major crops and food products, including maize (US EAS 2:2013), groundnuts (US EAS 57-1), sorghum (US EAS 757:2013), and rice (US EAS 128), among others. These national standards are harmonized with those of the East African Community (EAC) to ensure regional consistency and facilitate cross-border trade (FONUS, 2015).

- **Uganda's Adoption of the East African Standard on Aflatoxin Limits in grains and animal feeds**

The East African Community (EAC) has established regulatory limits for total aflatoxin levels in grains intended for human consumption, and animal feeds setting the maximum allowable concentration at 10 parts per billion (ppb), and 20 ppb respectively, as determined by the ISO 16050 testing standard (EAC, 2011). As a member state of the EAC, Uganda has formally adopted these standards, integrating them into the country's regulatory framework for aflatoxin control.

- **The National Grain Trade Policy (2015)**

Grains are a staple food in Uganda and worldwide, but they are highly vulnerable to contamination by aflatoxins, which pose serious health risks and negatively impact both domestic and international trade. In response, Uganda's Ministry of Trade, Industry and Cooperatives (MTIC) developed the National Grain Trade Policy in 2015. This policy emphasizes the importance of addressing aflatoxin contamination at all stages of the grain value chain. It also highlights the need to comply with established grain quality standards to ensure that traders and processors remain competitive in local and export markets. Ultimately, the policy aims to support farmers in increasing grain production efficiency, trading larger volumes of quality grain, improving storage practices, and enhancing overall food security (MTIC, 2015).

- **Establishment of the Grain Council of Uganda**

The Grain Council of Uganda (TGCU) is a non-profit, membership-based organization established in 2012 to unite key stakeholders across the grain value chain. Serving as a collaborative platform, TGCU facilitates coordination and strategic planning within the grains sub-sector. The Council has played a pivotal role in developing and implementing strategies aimed at preventing and controlling aflatoxin contamination, which poses a significant threat to grain quality. Additionally, TGCU has been instrumental in capacity building for stakeholders involved in grain production and trade, as well as in the development of information, education, and communication (IEC) materials in various local languages to enhance awareness and support advocacy efforts on aflatoxin mitigation (TGCU, 2024).

- **Uganda's Participation in the Partnership for Aflatoxin Control in Africa (PACA)**

Due to its high vulnerability to aflatoxin contamination, Uganda was chosen among the first six (6) pilot countries and is currently an active participant and beneficiary of PACA, a continental platform hosted by the African Union Commission in Addis Ababa, Ethiopia. PACA brings together 54 African countries and partners to coordinate efforts in combating aflatoxin-related challenges. The platform facilitates the development of comprehensive, government-led, and stakeholder-aligned aflatoxin control action plans at both national and regional levels. Key activities supported by PACA include conducting Country-Led Situational Analysis and Action Planning (C-SAAP) to inform national strategies, establishing the Africa Aflatoxin Information Management System (AfricaAIMS), and integrating food safety and aflatoxin control measures into National Agriculture Investment Plans (NAFSIPs). Currently, PACA activities have been incorporated within the African Union Food Safety Strategy 2022-2036 (AU, 2022)

- **Establishment of the Uganda Mycotoxins Mitigation Steering Committee**

In 2016, the Uganda Mycotoxins Mitigation Steering Committee (UMMSC) was formally established with the mandate to provide conceptual, strategic, and policy oversight to the Secretariat and the Aflatoxin Technical Working Group (ATWG). The Committee is responsible for guiding the planning, implementation, and coordination of mycotoxin mitigation efforts across Uganda (PACA, 2016).

- **Establishment of the National Technical Working Group on Aflatoxins**

In response to the significant aflatoxin burden in Uganda, the National Technical Working Group on Aflatoxins (NTWGA) was established to provide specialized technical support in addressing contamination challenges within the agricultural sector. The NTWGA's primary mandate is to coordinate collaborative efforts among key stakeholders, including government agencies, research institutions, non-governmental organizations, and the private sector.

The group is tasked with developing and implementing comprehensive strategies for aflatoxin control and mitigation across the country. Its responsibilities further extend to policy formulation and execution, coordinating research initiatives, conducting monitoring and surveillance activities, building stakeholder capacity, and performing risk assessment and management. Additionally, the NTWGA facilitates collaboration and networking while leading public awareness campaigns focused on aflatoxin prevention and control.

The NTWGA operates under the strategic guidance of the Uganda Mycotoxins Mitigation Steering Committee (UMMSC), contributing critical technical input to national mycotoxin mitigation efforts.

- **The National Strategic Action Plan for Prevention and Control of Aflatoxin**

In recognition of the critical need to address the aflatoxin contamination challenge, the Government of Uganda officially launched the Five-Year National Strategic Action Plan for Prevention and Control of Aflatoxin covering the period 2018/19 to 2023/24 (PACA, 2018). This comprehensive plan outlined a strategic framework aimed at reducing aflatoxin exposure across the country through coordinated interventions along agricultural value chains.

Key components of the plan included the promotion of good agricultural and postharvest practices to minimize contamination, strengthening public awareness and advocacy campaigns to educate

stakeholders and consumers, and enhancing public health management to mitigate aflatoxin-related health risks. Additionally, the plan emphasized the development and enforcement of robust policies and legislation to support sustainable aflatoxin prevention and control.

Through multi-sectoral collaboration, capacity building, research, and monitoring, the National Action Plan sought to safeguard food safety, improve public health outcomes, and facilitate trade by ensuring the availability of aflatoxin-compliant agricultural products.

- **Research and Innovation in Aflatoxin Control**

Extensive research on aflatoxins in Uganda has been carried out by various academic institutions, government agencies, individual researchers, and organizations like NARO and Consortium of International Agricultural Centers (CGIAR). These studies have provided critical evidence on the prevalence of aflatoxin contamination in food products across the country. Moreover, the research has elucidated the adverse impacts of aflatoxins on human health, trade, and the broader socio-economic development of Uganda. Importantly, these investigations have generated valuable recommendations essential for the effective prevention, control, and management of aflatoxin contamination.

In terms of innovation, a significant milestone was achieved on August 12, 2020, when the International Institute of Tropical Agriculture (IITA) and the National Agricultural Research Organisation (NARO) launched a collaborative effort to finalize the development of Aflasafe (IITA, 2020). Aflasafe is a biological control product designed to reduce aflatoxin contamination by more than 80% in major cereal grains and groundnuts. This product has been developed and tested in 15 districts across Uganda, and its successful scale-up is expected to substantially contribute to mitigating the aflatoxin burden nationwide (NACCRI, 2021).

Further advancing aflatoxin management, Uganda installed its first aflatoxin removal facility, known as Toxi-Scrub, in Soroti district in 2022. This technology effectively reduces aflatoxin levels in grains to 10 parts per billion (ppb) or below, meeting the recommended safety thresholds for human and animal consumption (Nilepost, 2022). In addition to removing aflatoxins, the Toxi-Scrub system is capable of eliminating other mycotoxins as well as various biological and physical contaminants, enhancing overall grain safety (Business News, 2022; Monitor, 2022).

Together, these research efforts and technological innovations represent critical advances in Uganda's ongoing fight against aflatoxin contamination, supporting improved food safety, public health, and economic outcomes.

- **Development of Food Laboratories and Aflatoxin Testing Services in Uganda**

Uganda has progressively enhanced its capacity for aflatoxin testing through strategic investments in both public and private sector laboratories. The UNBS established a dedicated food testing laboratory, which has been equipped with modern analytical instruments and accredited to perform aflatoxin testing in food products. This facility plays a pivotal role in ensuring compliance with national and regional aflatoxin standards, thereby promoting food safety and facilitating trade (UNBS, 2022).

In addition to UNBS, several government institutions have developed advanced laboratory capabilities for mycotoxin analysis. The National Agricultural Research Organisation (NARO) operates

specialized laboratories focused on agricultural research, including the detection and mitigation of mycotoxins in food and feed (NARO, 2021). Similarly, the Directorate of Government Analytical Laboratory (DIGAL) provides essential analytical services for food safety monitoring, including the quantification of aflatoxins (Ministry of Health, 2020). Furthermore, Makerere University, Uganda's leading academic institution, maintains state-of-the-art laboratories that support both research and training in food safety and mycotoxin analysis (Makerere University, 2023).

Complementing these public sector efforts, private sector actors have increasingly invested in food safety infrastructure. For instance, Chemiphar Uganda Ltd. has established modern and accredited food testing laboratories that offer aflatoxin and other hazard testing services. These facilities enhance the overall capacity for timely and accurate detection of contaminants within the food supply chain and provide critical support to exporters, processors, and regulatory agencies (Chemiphar, 2023).

Collectively, the establishment and accreditation of these laboratories underscore Uganda's commitment to improving food safety standards and mitigating the risks associated with aflatoxins. Sustained investment in laboratory infrastructure, capacity building, and inter-institutional collaboration remains essential to expand and maintain effective aflatoxin testing services nationwide.

CHAPTER 03 A review of the Current Gaps in Aflatoxin Prevention, Mitigation, Control, and Management and proposed Recommendations

3.1. The Current Gaps in Aflatoxin Prevention, Mitigation, Control, and Management

Despite ongoing efforts to address aflatoxin contamination in Uganda, the burden of aflatoxins continues to pose a significant obstacle to the country's socio-economic development. Several persistent gaps have limited the effectiveness of prevention, control, and management strategies for aflatoxins in Uganda. These critical challenges are outlined below:

- **Inadequacies in the Enforcement of Existing Policies, Acts, Regulations, and Standards**

Uganda has established numerous legal, regulatory, and institutional frameworks aimed at the prevention, control, and management of aflatoxins. However, these frameworks have historically been weak and have not been effectively implemented or coordinated (Agol, 2017; Lukwago, 2019; FoSCU, 2024).

A recent study by Kaaya (2023) highlights that the fragmented distribution of responsibilities across various government ministries, departments, and agencies continues to hinder the effective enforcement of these frameworks. This fragmentation has contributed to challenges such as limited funding for the relevant implementing bodies, corruption, and insufficient capacity to enforce regulations.

Moreover, poor coordination between sectors, weaknesses in policy formulation and implementation processes, and low public awareness about the existence and importance of these frameworks further exacerbate enforcement difficulties (FAO, 2023). Addressing these gaps is critical to strengthening Uganda's aflatoxin control efforts.

- **Limited Investment in Aflatoxin Prevention, Control, and Management Innovations**

Uganda continues to face significant challenges due to limited financial investment in research and innovation aimed at developing effective solutions for aflatoxin prevention, control, and management. As a country, Uganda has never had a separate budget specifically for the control and management of aflatoxins. Majority of the funding has been by development partners and for this reason, the National Strategic Action Plan for Prevention and Control of aflatoxins was never implemented. Although some innovative technologies have been developed, their widespread adoption and accessibility remain major obstacles to mitigating aflatoxin contamination across the country.For instance, ozonation technology, which has demonstrated the ability to remove aflatoxins from contaminated produce, is currently installed only in Soroti District. Consequently, access to this technology is largely restricted to communities within Soroti and its neighboring areas, leaving other regions, many of which produce aflatoxin-prone crops, without similar interventions.

Furthermore, key institutions mandated to coordinate and provide technical support for aflatoxin control, such as the National Technical Working Group on Aflatoxins, the Uganda Mycotoxins Mitigation Steering Committee, The Grain Council of Uganda, and the Uganda National Bureau of

Standards, have been hampered by inadequate funding. This financial constraint has limited their capacity to fulfill their core responsibilities effectively, resulting in reduced activity, inefficiency, and diminished impact in the national aflatoxin control efforts.

Addressing these funding gaps and enhancing investment in research, innovation, and institutional capacity is essential to strengthen Uganda's ability to manage and reduce the aflatoxin burden.

- **Low Coverage of Agricultural Extension Services**

In Uganda, the coverage of agricultural extension services remains insufficient to meet the needs of the farming population. Currently, the ratio of agricultural extension workers (AEWs) to farmers stands at approximately 1:1800, which is significantly higher than the national target ratio of 1:500 (FAO, 2023). This high farmer-to-extension worker ratio makes it practically impossible for extension services to effectively reach all farmers with the necessary training and support.

Agricultural extension services are crucial for building farmers' capacity in preventing and controlling aflatoxin contamination during crop production, harvesting, and post-harvest handling. However, the limited reach of extension workers undermines these efforts, leaving many farmers without adequate knowledge and guidance on best practices to mitigate aflatoxin risks (FAO, 2023).

A key factor contributing to this challenge is the low allocation of resources to the Directorate of Agricultural Extension in the Ministry of Agriculture Animal Industry and Fisheries (MAAIF). For instance, in the financial year 2020/2021, this Directorate received only 0.42% of the total agricultural budget, a proportion that is insufficient to effectively implement its strategic objectives and expand extension coverage (EPRC, 2022).

Addressing the low coverage of extension services through increased funding and strategic resource allocation is essential to enhance farmers' capacity and reduce the prevalence of aflatoxin contamination in Uganda's agricultural sector.

- **High Costs and Limited Accessibility of Aflatoxin Testing and Control Technologies**

Although several appropriate technologies for aflatoxin prevention and management, such as drying on tarpaulins, hermetic storage using PICS bags, and nixtamalization, are accessible and affordable to many farmers, significant challenges remain regarding the affordability and accessibility of advanced testing methods and high-technology interventions.

The cost of aflatoxin testing, particularly mobile and rapid testing kits, remains prohibitively high for smallholder farmers and micro, small, and medium-sized enterprises (MSMEs). Similarly, aflatoxin testing services offered by UNBS and private laboratories are often expensive and geographically distant from rural farming communities, limiting their practical use by the majority of farmers and traders.

Moreover, sophisticated technologies such as ozonation and the Toxi-Scrub system, which have demonstrated effectiveness in reducing aflatoxin contamination, are currently unaffordable for individual farmers and SMEs to acquire and operate independently. This situation highlights the urgent need for government intervention to subsidize or invest in the deployment of these technologies to ensure wider accessibility.

Additionally, accelerating the commercialization and distribution of biological control products such as Aflasafe is critical to enabling farmers to adopt effective aflatoxin mitigation strategies at scale.

Addressing these cost and accessibility barriers through targeted public investment and policy support will be essential to enhance the adoption of aflatoxin control technologies, thereby improving food safety and protecting public health across Uganda.

- **Insufficient Stakeholder Awareness on Aflatoxin Prevention, Control, and Management**

Despite ongoing awareness campaigns conducted by various organizations, the overall reach and impact of these efforts remain limited across Uganda. Consequently, a significant number of stakeholders, including farmers, traders, processors, and consumers, lack adequate knowledge of the recommended practices essential for the effective prevention, control, mitigation, and management of aflatoxins.

This low level of awareness is largely attributed to insufficient allocation and availability of critical resources, including human capacity, financial support, and infrastructure. The complexity of addressing aflatoxin contamination requires substantial and coordinated investments, which have so far been inadequate. As a result, many actors remain uninformed or under-informed about the risks posed by aflatoxins and the best practices to minimize exposure.

Enhancing stakeholder awareness through increased resource allocation and targeted educational initiatives is crucial to improving the effectiveness of aflatoxin mitigation efforts nationwide.

- **Limited Capacity to Adequately Control Aflatoxins**

Uganda's capacity to implement effective aflatoxin control systems remains constrained by systemic challenges. Government ministries and departments responsible for aflatoxin mitigation face significant limitations in infrastructure, financial resources, and human capacity, which hinder their ability to enforce existing aflatoxin standards (Kaaya, 2023). These constraints are compounded by a lack of specialized equipment for aflatoxin analysis and insufficient funding allocated to regulatory bodies.

Current monitoring efforts are largely restricted to export-oriented produce, with UNBS conducting aflatoxin surveillance at border entry points for imported goods. However, domestic markets and locally consumed products remain inadequately monitored, leaving gaps in food safety oversight.

While the private sector, including traders, processors, and development partners, promotes good agricultural and postharvest handling practices, these initiatives are hampered by limited resources to systematically monitor or enforce compliance with aflatoxin regulations (Omara, 2020). For instance, efforts to scale up aflatoxin testing and adopt mitigation technologies are often inconsistent due to financial and logistical barriers.

Collectively, these systemic deficiencies underscore the inadequacy of existing structures to ensure the provision of aflatoxin-safe foods to the public. Strengthening institutional capacity, increasing resource allocation, and expanding monitoring frameworks to include domestic markets are critical steps toward addressing these gaps.

3.2. Proposed Recommendations to Address Aflatoxins

In light of the significant health, trade, and socio-economic impacts of aflatoxins, as well as the critical gaps identified in the preceding sections, the Food Safety Coalition of Uganda (FoSCU) puts forward the following strategic recommendations to strengthen aflatoxin prevention, control, and management across the country;

- **Enforcement of Existing Legal, Regulatory, and Institutional Frameworks**

To effectively mitigate the aflatoxin challenge, the Government of Uganda must prioritize the enforcement of existing laws, policies, regulations, and standards specifically designed to address aflatoxin contamination. Strengthening enforcement mechanisms is essential to ensure compliance and safeguard public health and trade interests.

Concurrently, the government should accelerate the operationalization of mandates assigned to various institutions established to support aflatoxin mitigation efforts. This includes providing these bodies with adequate resources and clear directives to enhance coordination and implementation of control measures.

Strategic planning and dedicated budget allocations are critical to the successful execution of national action plans and strategies aimed at aflatoxin prevention and control. The government must ensure that sufficient financial resources are earmarked to support these initiatives sustainably.

In addition, it is imperative to review and update any outdated legal and regulatory frameworks promptly. This process should incorporate emerging challenges, scientific advancements, and innovative technologies to ensure that Uganda's aflatoxin control policies remain relevant and effective in the evolving agricultural and food safety landscape.

Finally, we recommend the formulation and enactment of bylaws and ordinances at the district and local council levels to streamline the implementation process. These localized regulatory frameworks are typically more agile and can be established with greater expediency compared to higher-level legislation. Moreover, their proximity to the community facilitates more effective monitoring, enforcement, and adaptation to emerging challenges, thereby reducing bureaucratic delays and enhancing overall governance efficiency.

- **Increasing Investment in Aflatoxin Prevention, Mitigation, and Control**

To effectively address the aflatoxin burden in Uganda, it is essential to establish a dedicated budget specifically for aflatoxin control and management. Several countries like Kenya and Tanzania have done so and are being successful in the management of this challenge. This targeted funding would support a range of critical activities, including capacity building for human resources, infrastructure development, and public awareness campaigns, among others.

The nation must prioritize and significantly increase investment in scientific research and innovation that provide practical solutions for preventing, mitigating, and controlling aflatoxin contamination. Such investment should also extend to making aflatoxin testing more accessible. This includes subsidizing mobile and rapid testing equipment that can be easily used by farmers and traders in the field.

For larger-scale aflatoxin detection, the government should ensure that testing services are affordable and that laboratories are strategically located closer to the communities that need them. This approach will reduce barriers to testing and improve early detection and management of contaminated produce.

Proven technologies such as Aflasafe, a biological control agent, and Toxi-Scrub, an aflatoxin removal system, should be scaled up nationwide to enhance accessibility for farmers and traders. Expanding the use of these technologies will contribute significantly to reducing aflatoxin levels in agricultural products.

Additionally, the Food Safety Coalition of Uganda (FoSCU) recommends further investment in relevant infrastructure to support aflatoxin control efforts. This includes establishing regional laboratories dedicated to aflatoxin testing, including availability of simple testing kits for farmers and traders, installing aflatoxin cleansing technologies across key production areas, and developing robust monitoring systems to track contamination levels effectively.

By increasing and strategically allocating investments in these areas, Uganda can strengthen its capacity to manage aflatoxins, protect public health, and improve the competitiveness of its agricultural products in both domestic and international markets.

- **Capacity Building and Strengthening**

To effectively address the challenges posed by aflatoxins, the government should prioritize and allocate sufficient resources towards capacity building and strengthening of technical teams. This investment should focus on empowering scientists and technical experts with the skills and tools necessary to locally manufacture, service, and maintain aflatoxin detection equipment.

Moreover, technocrats involved in aflatoxin prevention and control must be equipped with comprehensive knowledge and practical skills related to various mitigation mechanisms. This will enable them to effectively engage and support farmers, traders, and other stakeholders along the agricultural value chain with evidence-based and practical solutions.

By enhancing the technical capacity of these teams, Uganda can improve the implementation of aflatoxin control interventions, ensuring that innovations and best practices reach those most affected by aflatoxin contamination.

- **Expanding Coverage for Aflatoxin Awareness Creation**

Limited awareness of aflatoxins remains a critical challenge that requires immediate and sustained attention. The Food Safety Coalition of Uganda (FoSCU) recommends that the government prioritize nationwide awareness campaigns on aflatoxin risks and prevention. These campaigns should utilize diverse, efficient, and inclusive communication channels to reach all relevant stakeholders effectively.

In particular, the Ministry of Agriculture, Animal Industry and Fisheries (MAAIF) should urgently increase the recruitment of Agricultural Extension Workers (AEWs). Additionally, these extension workers must be adequately empowered and supported with the necessary resources and training to conduct comprehensive awareness-raising activities. Strengthening the capacity of AEWs will

enable them to effectively engage with farmers across Uganda, ensuring that critical information on aflatoxin prevention and control is widely disseminated.

By expanding awareness coverage through well-coordinated efforts, Uganda can enhance stakeholder knowledge and participation in mitigating the aflatoxin burden.

- **Rejuvenation and Strengthening of Farmers' and Traders' Cooperatives**

The government, through the Ministry of Trade, Industry, and Cooperatives, should prioritize the revitalization and formation of farmers' and traders' cooperatives nationwide. Strengthening these cooperatives will facilitate coordinated efforts in raising awareness, enhancing capacity building, mobilizing resources, ensuring quality assurance, and improving market competitiveness for all members.

By fostering robust cooperative structures, the government can promote collective action that empowers smallholder farmers and traders, thereby enhancing their ability to effectively participate in aflatoxin prevention and control initiatives as well as broader agricultural value chains.

Conclusion

Addressing the aflatoxin challenge in Uganda requires urgent and coordinated multisectoral action to ensure the country meets the objectives outlined in the Fourth National Development Plan (NDP IV) and achieves its long-term Vision 2040, alongside the Sustainable Development Goals (SDGs).

The government must assume a central leadership role in accelerating, mobilizing, coordinating, and monitoring aflatoxin mitigation efforts across all relevant sectors. This includes ensuring the effective enforcement of existing legal, regulatory, and institutional frameworks designed to control and manage aflatoxin contamination.

Equally important is the prioritization of widespread community awareness campaigns and targeted capacity-building initiatives to equip stakeholders ranging from farmers to traders and policymakers with the knowledge and skills necessary to implement practical aflatoxin prevention and control measures.

Furthermore, increased investment in scientific research and innovation is essential to develop and disseminate effective technologies and strategies that empower stakeholders to reduce aflatoxin risks sustainably. Through these integrated efforts, Uganda can significantly mitigate the adverse health, economic, and social impacts of aflatoxins, thereby advancing national development and public health goals.

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FoSCU Membership

Consent Global Consumer Centre

CropLife Uganda

FRA Food Rights Alliance

KRC Uganda Research, Advocacy & Development

Uganda National Agro-Input Dealers' Association UNADA

RUCID Rural Community in Development Rural Agricultural Training College Hope for the Future

UNACOH "Health for All & By All"

AFIRD

Uganda National Farmers Federation Farming is Honourable and Dignifying

Caritas Uganda

Dimensional Pictures Design & Production Agency

Gender-Environment & Development Action-Uganda

Hortexa

Bask Organics

AUPWAE

Makerere University College of Agricultural & Environmental Sciences

RTC Paramount Research Triangle Consortium (RTC) Uganda

rikolto

Rural Development Media Communication

Sukuma Enhancing Agribusiness Development

Swiss TPH Swiss Tropical and Public Health Institute

UAA Uganda Agribusiness Alliance Partnering for Growth

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