Grains and Legumes
Value Chain & Market Systems
Case Study

Food safety hazards can be broadly classified into three categories: physical, chemical and biological.

> **Physical hazards** include any contaminant other than the commodity such as weeds, metals, glass, stones or any non-edible substance harmful to a consumer.
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> **Chemical hazards** include pesticide residues that exceed allowable limits, mycotoxins (aflatoxins, fumonisin, or ochratoxins) due to fungal infection or other chemical contamination such as heavy metals (lead, mercury, iron, or cadmium) that may occur in the field, storage or processing facility.
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> **Biological hazards** are caused by bacteria, viruses and other microorganisms.

Bulk commodities such as rice, maize, millet, and groundnut are a major source of human food and animal feed across West Africa. Some of these commodities are processed into food products for consumption while some are consumed with minimal processing (such as cleaning). To ensure that the final food product is safe and healthy, the grain/legume must remain free of food safety hazards through production, harvesting, storage, transportation, processing, and sale. There are many potential food safety hazards associated with grains/legumes such as chemical residues, field and storage fungi, mycotoxin, rodents and pests, storage contamination (on-farm, during transportation and in processing facilities), and hazards associated with processing.

The impact of pesticides

The potential cost of pesticide-related illnesses in sub-Saharan African between 2005 and 2020 could reach $90bn (£56bn), according to a recent UN report highlighting the growing health and environmental hazards from chemicals. It said the estimated cost of pesticide poisoning exceeds the total amount of international aid for basic health services for the region, excluding HIV/Aids. The report by the UN environment programme (Unep) warned that the increasing production of chemicals, especially in emerging economies where there are weaker safeguards, is damaging the environment and increasing health costs.[1] With the arrival of off-patent Asian pesticides West Africa, prices have been cut in half and applications have exploded. In Mali, for example, more than half of all sorghum farmers and two thirds of maize farmers no apply pesticides in order to save time and labor costs, mainly in weeding.[2]

Heavy metals in rice

The rice plant is an effective scavenger of metals resulting in grain contamination with the heavy and toxic metals arsenic and cadmium taken up in polluted environments. Unfortunately, studies completed to demonstrate a reduction in arsenic uptake in rice through lowering water levels in rice paddies showed that cadmium uptake was increased. Cadmium is a component of fertilizer, and excessive use of poor quality fertilizer is a significant risk factor for disease due to the metal. Cadmium is also found in pesticides, and is a component of some storage containers' structure. Pollution from smelting, mining and other heavy industry can result in the metal's becoming concentrated in adjacent soil and water. There is thus a risk that the metal may become incorporated in a food product at several points along the rice value chain. Cadmium exposure is harmful to humans on both an acute and chronic basis, causing "itai-itai" (susceptibility to bone fractures) and kidney disease amongst other serious ailments. [3]

Aflatoxin contamination

This difficult to detect food contaminant can survive a wide range of processing techniques, including cooking. It can cause both chronic and acute illness, with particular harm arising from liver failure and cancer. The toxic fungal metabolites are found in maize, groundnuts and other crops as well as milk collected from animals fed contaminated feed. Each year, Africa loses US$670 million due to aflatoxin contamination of food products. Multiple outbreaks of aflatoxin poisoning have occurred resulting in

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[1] https://www.theguardian.com/environment/2012/sep/06/pesticides-hazardous-chemicals-un
[2] USAID/West Africa Buy In to the Food Security Policy Innovation Laboratory Quarterly Report for January–March, 2017
[3] Cadmium, Environmental Exposure and Health Outcomes; Soisungwan Satarug, Scott H. Garrett, Mary Ann Sens, and Donald A. Sens; doi: 10.1289/ehp.0901234 (available at http://dx.doi.org/)

disease and death; in 2016, 14 people died in Tanzania and scores of others fell seriously ill after consuming contaminated maize. According to the World Health Organization, some 4.5 billion people are chronically exposed to aflatoxin around the world. Public health aside, this mycotoxin can have a devastating effect on producer incomes, trade and food security. Africa is particularly vulnerable to aflatoxin due to its climate, inadequate harvesting and storage conditions and minimal food safety inspection and enforcement capabilities. Lack of awareness among producers, processors and consumers compound the problem. Some 40 percent of commodities in local African markets exceed allowable levels of the toxin.[4]

As illustrated above, grain/legume value chains are at risk for a variety of food safety hazards. These hazards can lead to low-quality or contaminated food and feed products, resulting in compromised food safety in domestic and international markets. Some intersections between grain/legume value chain activities and food safety risks include:

- Inappropriate and/or excessive use of low quality pesticides and fertilizers.
- Poor and/or unsanitary storage practices that permit fungal growth, rodent contamination, etc.
- Use of water contaminated by heavy metals for crop washing, sorting, processing.

[4] http://www.cta.int/en/article/2016-11-30/day-2-aflatoxin-on-the-trail-of-the-silent-killer.html