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# Mitigating Harmful Effects of Aflatoxin on Animal Health and Productivity

## EXECUTIVE SUMMARY

Livestock plays a key role in the economies and livelihoods of the people in the East African Community (EAC). The sector contributes an average of 10% of GDP of EAC partner states. Average contribution of livestock to agricultural GDP is between 30% and 15%. Despite the potential, the sector is faced with many challenges including aflatoxin related impacts on animal health and productivity.

Aflatoxin is a poison produced by a fungi residing in the soil and dead decaying matter in the field and infect crops such as maize, groundnuts, cassava and bean among others while they are still on the farm, (pre-harvest) after harvest during storage (post-harvest) and also during storage and processing. All animals are affected by consumption or exposure to aflatoxin especially through contaminated feeds as well as pastures, hay, straw and silage among others and this contributes to various livestock diseases and low livestock productivity especially highly susceptible animals such as rabbits, ducks, and pigs dogs, calves, turkeys and sheep, cattle and chick among others. Aflatoxin has proven to have negative health impacts on animals, which include death from ingesting large amounts; lowered productivity; and immunosuppression. In mammals, acute and chronic *Aflatoxicosis*, may lead to damage of the liver and other effects on animal health and productivity. *Aflatoxicosis* is the poisoning that results from ingesting aflatoxins in contaminated food or feed.

Numerous studies on African livestock indicate annual mortality is high. Literature review revealed that annual livestock mortality varies from 6% to 28% across all species and age groups, with around 25% of young animals dying each year (Otte and Chilona2002). Annual mortality of backyard poultry is 30% to 80%. The majority of this loss is due to infectious disease, with malnutrition a secondary cause (Grace et al. 2012). Worldwide, aflatoxins are the most important contaminant of commercial animal feeds. In sub-saharan Africa, most feed samples contain aflatoxins and many contain aflatoxins above the recommended limits. This suggests that aflatoxin could be one of the factors contributing to the current burden of livestock disease.

The impact of aflatoxin on animal productivity is widely documented. For example, studies show that chickens fed on contaminated feed weighed from 38% to 97% less than birds fed on normal diets. Layers given 10000 ppb reduced egg production by 70% (Huff et al. 1975). A review of multiple studies showed that mycotoxins in diets reduced pig weight gain by 21% (Andretta et al. 2011). In pigs, every extra 1000 ppb in pig feed was associated with a 3.9% extra decrease in weight (Andretta et al. 2011). In broilers, for every mg/kg (1000 ppb) increase of aflatoxin in the diet, the growth rate would be reduced by 5%.

Since aflatoxins cannot be completely prevented in crops, improved pre and post-harvest measures are crucial. Strong local, national, and regional regulatory environment is needed to prevent highly contaminated crops from entering feed and food chains. However, regulations are not enough. There is need for skilled human capacity, reliable and affordable technologies and infrastructure for quality assurance on management of aflatoxins. Enhancing of awareness on aflatoxin prevention and control is an area that calls for concerted efforts at all levels.

## THE PROBLEM

The East Africa region has one of the highest levels of aflatoxin contamination. This has undermined animal health and productivity. All animals are affected by consumption or exposure to aflatoxin especially through contaminated feeds as evidenced by studies conducted in the region. Aflatoxin is a major concern for the livestock sector in particular cattle, chickens and poultry. In the case of cattle, the main concern is transfer of aflatoxin to milk. In the case of pigs and poultry, the concerns are negative health impact and reduced production due to chronic exposure, because their feeds contain more of cereals and oilseeds prone to aflatoxin. Human exposure to Aflatoxin may result from consumption of plant derived foods that are contaminated or through animal products such as milk, meat and eggs. Aflatoxins in milk are of concern because milk consumption is often higher among infants and children, who are likely to be more vulnerable. With growing human population and the inclination of consumption patterns towards animal protein, Aflatoxin Impacts are likely to worsen as livestock industries intensifies in response to growing demand for meat, milk, fish, and eggs.

The harmful effects of aflatoxins on animal health and productivity include liver cancer, inborn deformities and malformations, reduced body growth and weight, as well as , reduced resistance to some infectious diseases despite vaccination and this may result in deaths.

In less severe cases, the effect of aflatoxin consumption and exposure in animals includes vomiting, depression, hemorrhage, and jaundice, general body weakness, lack of appetite, reduced growth and malnutrition and occasional sudden deaths.

Although the effects of acute aflatoxicosis can be dramatic with high mortality in animals, the impact on production, and thus economics, are even higher due to chronic exposure (Kolosova and Stroka 2011).

## SIZE OF THE PROBLEM

Studies conducted in East Africa depict high Aflatoxin contamination levels in animal feeds. In Morogoro, Tanzania, 20% of maize bran, 25% of sunflower cakes, 30% of layer starter and finisher and 67% of broiler starter and finisher had aflatoxins>20 ppb (Kajuna etal, 2013).

A total of 830 feed and 613 milk samples from four urban centres in Kenya were analysed for aflatoxin B1. Some 86% (353/412) of the feed samples from farmers were positive for aflatoxin B1 and 70% (248/352) of the samples had aflatoxin levels that exceeded 5ppb the WHO/FAO limit for feeds destined for dairy animals (Kang'ethe and Lang'at 2009).

In Kenya, feed samples were contaminated with aflatoxin ranging from 35.8- 595 ppb (Kang'ethe and Langat 2009; Kaaya 2011, and Kajuna et al. 2013). Aflatoxicosis outbreaks among animals have been reported in Kenya since 1962 with the death of turkey, dogs (Price and Hoinonen 1978 and Manwiller 1987), and poultry (Mbugua and Etale 1987).

In Uganda, aflatoxigenic Aspergillus spp were detected in 83% of livestock and 67% of poultry feed samples (Sebunya and Youtee1990). An average aflatoxin level of 109.68 ppb was found in animal feeds sampled in Sudan (Elzupir etal 2009).

**Table 1:**
Aflatoxin limits in animal and fish feeds by animal type

| Species | Range of aflatoxin limits (ppb) | Average aflatoxin limit (ppb) |
|---|---|---|
| All animals | 5-300 | 48 |
| Pigs | 0-300 | 40 |
| Cattle | 0-300 | 41 |
| Poultry | 0-300 | 33 |
| Sheep goats | 5-75 | 26 |
| Dairy | 0-75 | 19 |
| Duck/turkey/rabbit/trout | 10-10 | 10 |

Source: Agag 2004

**Table 2:**
Range and average aflatoxin limits in animal and fish feeds by feed type

| Feed type | Range of aflatoxin limits (ppb) | Average aflatoxin limit (ppb) |
|---|---|---|
| Low risk feeds | 5-50 | 20 |
| Complementary/concentrates | 5-30 | 23 |
| Complete/combined/mixed | 25-100 | 25 |
| All feeds | 20-100 | 29 |
| Straight/cereal | 20-200 | 82 |
| Corn/cottonseed/peanut/copra | 5-300 | 85 |

Source: Agag 2004

## CAUSE OF THE PROBLEM

Livestock are exposed to aflatoxins through contaminated feeds. Pasture, hay, straw and silage are prone to contamination with aflatoxin but the levels are very low. The major source of aflatoxin ingested by animals comes from commercially formulated feeds. The feed ingredients maize, cotton seed, copra wheat and groundnuts are commonly contaminated and are the major source of aflatoxin exposure of animal feeds (FAO 2008). Impacts are likely to worsen as livestock industries intensify in response to growing demand for meat, milk, fish and eggs.

Despite the fact that animal feeds are the major source of aflatoxin exposure to animals, very few studies have been done on aflatoxin contamination of animal feeds in East Africa. For instance, no studies have been done to assess the amount of aflatoxin in eggs although low levels have been reported elsewhere due to low transmission from feed to eggs (Zaghini et al 2005).

**Table 3:**
Aflatoxin contamination of Maize, Wheat and Groundnuts

| Commodity | Country | Maximum Aflatoxin levels detected (ppb) | Reference |
|---|---|---|---|
| Wheat | Kenya<br>Rwanda | 7<br><10 | Muthomi et al. 2008<br>Personal communication (RBS 2014) |
| Maize | Kenya<br>Uganda<br>Tanzania<br>Rwanda | 791<br>1000<br>50<br>>20 | Alakonya et al. 2009<br>Kaaya 2011<br>TFDA (2012)<br>Personal communication (RBS 2014) |
| Groundnuts | Kenya<br>Uganda<br>Tanzania<br>Rwanda | 4050<br>2000<br>20<br><10 | Mutegi 2010<br>Kaaya 2011<br>TFDA 2012<br>Personal communication (RBS 2014) |

Source: Tanzania Food and Drug Authority (2012); Abt Associates, Inc.

## POLICY OPTIONS/RECOMMENDATIONS

The proposed interventions below will contribute towards mitigating harmful effects of aflatoxin on animal health and productivity.

**POLICY OPTION 1: DEVELOPMENT OF POLICY AND REGULATORY FRAMEWORK ON USE OF AFLATOXIN BINDERS**

- EAC Partner States should conduct studies on the level of efficacy and safety of aflatoxin binders in order to guide development of regulatory frameworks for their application in mitigating the effects of aflatoxin on animal health and productivity.

**Justification for option 1**

- Aflatoxin binders are widely applied in all EAC Partner States by feed producers, although they are not registered as such. Their efficacy for the indigenous production and industry context is unknown. Research on their appropriate use is necessary, as it will help inform legislative and regulatory direction as it pertains to their safe and appropriate commercial use.
- Binding agents such as zeolite clays and alumina silicates is effective in reducing toxicity. Studies in the United States found that when zeolite clays were included in feed at a ratio of 200 parts feed to one part binding agent, they reduced most of the harmful effects of aflatoxins at levels of 1000 ppb in pig and 7000 ppb for poultry. Their cost was around USD$0.25 per ton of feed (Grace 2014).

**POLICY OPTION 2: RESEARCH TO FACILITATE HARMONIZATION OF AFLATOXIN RISK ASSESSMENT AND MANAGEMENT SYSTEM FOR ANIMAL HEALTH**

- EAC Partner States should invest in research in order to quantify aflatoxin prevalence in animal and fish feeds from different agro-ecological zones, farming systems and breeds. Such studies will generate data that would inform mitigation measures, and the development of policies, regulations and standards on certification of aflatoxin-free feeds.

**POLICY OPTION 3: CREATING AN ENABLING ENVIRONMENT FOR ASSESSMENT AND DEPLOYMENT OF AFLATOXIN PREVENTION CONTROL TECHNOLOGIES IN ANIMAL HEALTH**

- EAC Partner States should conduct feasibility and cost-benefit analysis of adopting innovative technologies (such as ammonization and nixtamalisation) and promotion of best practices for handling contaminated aflatoxin feeds and feeds products.

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