Minireview Article

Aflatoxin B1 affects Kenyan Markets: how it can be managed

Abstract

Aflatoxin B1 is a toxin produced as secondary fungal metabolites by the fungus *Aspergillus*, particularly *A. flavus*. The toxin has significantly contaminated the food supply chain especially cereals in Kenya. Kenya Bureau of Standards (KEBS) has recently banned five maize flour brands, citing high aflatoxin levels. They also suspended seven peanut butter products and the permits of their parent companies over aflatoxin contamination. The huge losses encountered by these companies calls for concerted efforts to manage aflatoxin in cereals. Aflasafe, a natural product for controlling poisonous *A. flavus* in food crops, including maize is made from roasted sterile sorghum (usually colored blue using food color) coated with non-poison producing types of A *flavus* native to Kenya. The product is broadcasted in the maize fields during flowering and after exposure to sufficient moisture, the friendly Aflasafe fungi grow out as green spores containing millions of spores that are eventually spread to the crop, carried by wind and insects in the manner that aflatoxin-producing fungi are spread.

Keywords: Aflotoxin; Aflotoxin B1; *Aspergillus flavus;* Aflasafe

1. Introduction

Aflatoxins are toxins produced as secondary fungal metabolites by the fungus *Aspergillus*, particularly *A. flavus*. The fungus produces aflatoxin B1 (AFB1), aflatoxin B2 (AFB2), aflatoxin G1 (AFG1) and aflatoxin G2 (AFG2) (Blake and Mustafa, 2019). It has been proven epidemiologically and documented (IARC, 2012) that aflatoxins, especially AFB1 is a carcinogen. It causes hepatocellular carcinoma, suppresses growth, modulates the immune system and leads to malnutrition (IARC, 2012). *A. flavus* is found in almost all soil types and it can contaminate the food chain either at flowering or post-harvest stages producing AFB1. High temperatures and humidity promote its growth.

AFB1 significantly contaminates the food supply chain especially cereals in Kenya. For instance, in 2013, farmers in Tana River County lost their maize harvest due to infections by aflatoxins (Dominic, 2019). The whole harvest at the Hola Agricultural Irrigation Scheme for maize of approximately 5,400 tones was affected by aflatoxins. The levels of aflatoxins were over the standard level 10 ppb. Maize reserves of about 207000 tons were also declared infected by aflatoxins in 2010 (Dominic, 2019). The trend continues in Kenya today making aflatoxin infection a threat to food supply chain. Most recently, Kenya Bureau of Standards (KEBS) banned five maize flour brands, citing high aflatoxin levels (Nation, 2019). Their permits were suspended and the manufacturers instructed to discontinue manufacturing or offering for sale the affected maize meal products. The five products were Dola by Kitui Four Mills, Kifaru by Alpha Grain Limited, Starehe by Pan African Grain Millers, 210 Two Ten by Kenblest Limited and Jembe by Kensal Rise Limited (Nation, 2019). Furthermore, KEBS also suspended seven peanut butter products and the permits of their parent companies over aflatoxin contamination. Among the products affected include Nuteez peanut butter, True nuts, Fressy, Supa meal, Sue's Naturals, Zesta and Nutty (Mireri, 2019). Definitely the aforementioned banns had serious financial implicatiom.

2. How Aflatoxins spreads

Although the fungus affects maize crop at the flowering stage, poor post-harvest practices including un-aerated storage and/or delays in reducing moisture content of the maize contribute immensely to aflatoxin infection/spread (**see fig. 1**). Mechanized shredding of the maize that is not able to isolate affected maize also increases infections. It should be noted that aflatoxins infections are positively affected by dry climate. Therefore most of the irrigation schemes in dry areas for maize production in Kenya should consider aflatoxin infection as a threat. However, although sorting of cereals (maize) may help reduce fresh infections from *A flavus* fungus whose infection is usually visible (**see Fig. 1**), AFB1 compound is colorless, odorless and tasteless. As such use of visual techniques to detect the compound can be misleading and should be avoided. Use of test kits that are readily available in the market should be encouraged.

3. Prevention of aflatoxin B1 in stored cereals

Food security is part of the Kenyan Governments Agenda and as such appropriate post-harvest practices should be employed to reduce loses. The use of hematic bags, cereal drying machines, grain cocoons or silos can reduce loses significantly. Furthermore, farmers can use the 'Alfasafe' technology to control *A. flavus* fungus during the flowering stage (Japhet, 2017).

4. How to manage Aflatoxins B1 in the field

Aflasafe is a natural product for controlling poisonous *A. flavus* in food crops, including maize. It is roasted sterile sorghum (usually colored blue using food color) coated with non-poison producing types of A *flavus* native to Kenya (Japhet, 2017). The product is broadcasted in the maize fields during flowering and after exposure to sufficient moisture, the friendly Aflasafe fungi grow out as green spores containing millions of spores that are eventually spread to the crop, carried by wind and insects in the manner that aflatoxin-producing fungi are spread.

5. How to manage affected cereals

Other cases of aflatoxins infections in Kenyan cereals include peanut butter that was reported to contain aflatoxin, 24 ppb way above the recommended 10 ppb. As such, it is advisable for farmers to be sensitized so as to control aflatoxin during flowering and good post-harvest handling practices. Contaminated cereals beyond both human (<10 ppb) and animal (<300 ppb) (Blake and Mustafa, 2019) consumption maybe considered for generating ethanol for industrial use instead of total destruction. Levels of AFB1 in such ethanol should be indicated as the toxin has been documented to show traces in the final finished fermented product (Tomonori et al., 2013). However such ethanol can be used for general industrial use like in making printing inks, paints and coatings, screen wash and deicers for the automotive industry, etc (IEA, 2007).

6. Conclusions

It is important for companies to invest heavily in aflatoxin detection in cereals before buying and storing. Their storage should be robust including the use of hematic bags, cereal drying machines, grain cocoons or silos. Farmers should also be advised to employ the Aflasafe technology in controlling field infections of aflatoxin B1. The technique involves the use of roasted sterile sorghum coated with non-poison producing types of A *flavus.* After exposure to sufficient moisture, the friendly *Aflasafe* fungi grow out as green spores containing millions of spores that are eventually spread to the crop, carried by wind and insects in the manner that aflatoxin-producing fungi are spread.

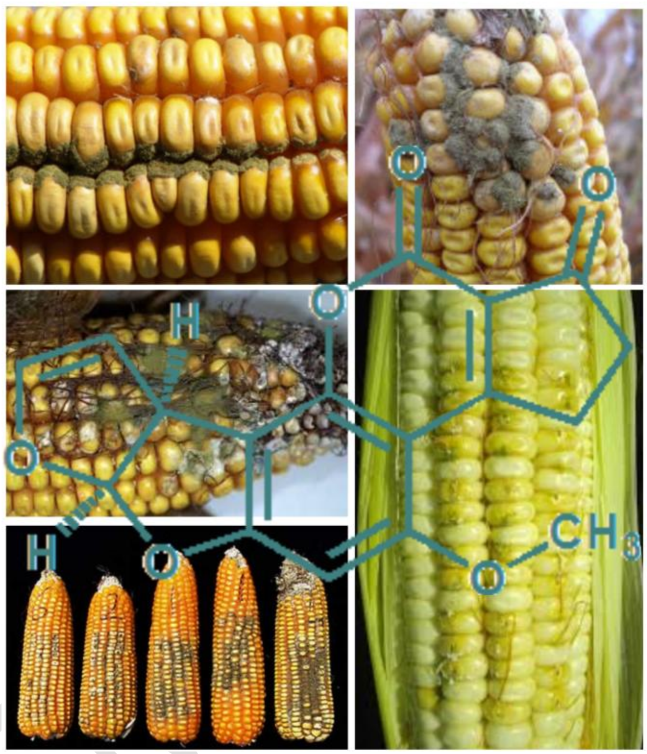

Fig.1. Samples of maize affected with *A. flavus* fungus in Kenya

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