

# CGIAR research to combat mycotoxin impact in Africa

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RESEARCH  
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Nutrition  
and Health  
Led by IFPRI



# What is the issue with aflatoxins?

In Kenya

In Africa

In the world

## DANONE In Aflatoxin Crisis: Dairy Products Recalled from Romanian Market

Posted on [March 18, 2013](#)

**UPDATE 19 March 2013.** Lab test results certify that aflatoxin levels were within European margins (e.g. a maximum of 0.05 micrograms per kilo). **Danone Romania** has announced today that it had received the official results on the level of aflatoxin existing in the products recalled yesterday from the national market indicating that aflatoxin levels were below the European legal margins and safe for consumers. However, all recalled products (some 60 tons of yoghurt and cream) shall be destroyed.

Tell me where you buy your yoghurt from, so that I know what type of cancer you're likely to develop! As if the horsemeat scandal was not enough these months, Romania is leading yet another food security scandal including a dairy [aflatoxin](#) scare as well.



# Not only aflatoxins

<b>Mycotoxin</b>	<b>Main fungi</b>	<b>Impact on animal health</b>
<b>Aflatoxins</b>	<i>Aspergillus</i> spp.	All livestock susceptible to different degrees Acute toxicity, hepatotoxic and nephrotoxic Carcinogenic and mutagenic Growth impairment. Immunosuppression
<b>Ochratoxin A</b>	<i>Aspergillus</i> spp., <i>Penicillium</i> spp.	Nephrotoxic Immunosuppression Possibly carcinogenic
<b>Fumonisin</b>	<i>Fusarium</i> spp.	Toxic to liver and central nervous system Possibly carcinogenic
<b>Zearalenone</b>	<i>Fusarium</i> spp.	Swine highly sensitive, cattle less sensitive. Endocrine disruption. Estrogenic effects, reduced reproduction, feminisation, malformations.
<b>Trichotecenes</b>	<i>Fusarium</i> spp.	Gastrointestinal disturbance. Reduced feed intake. Ill-thrift. Immunosuppression.

# Aflatoxins are a major issue

- Estimated that total mycotoxin losses in the USA are 1.4 billion USD annually
- Some years farmers are forced to dispose of half their crops of corn and peanuts
- Thailand, Indonesia, the Philippines total market loss: 200 million USD (and 700 million USD costs for livestock losses and health costs)

# Major effects on trade

When EU harmonized the limits:

- Decrease to 4 ppb: saves 2 lives per billion
- Europe receives 57% of African and Middle Eastern exports
- Estimated to decrease African exports by 64% (670 million USD)
- Peanuts one of Africa's few export commodities (Gambia, Senegal, South Africa)

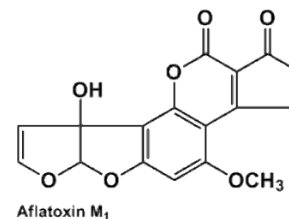
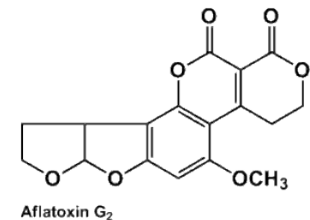
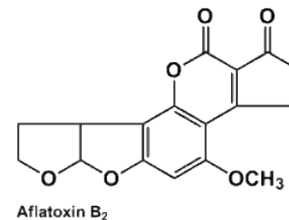
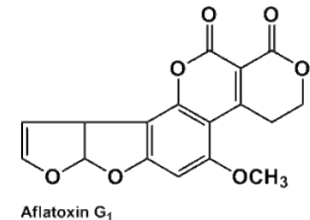
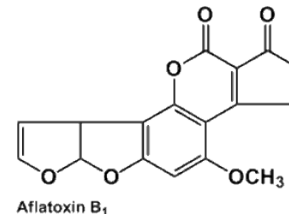
# .. And that is only the monetary values

- Acute outbreaks can claim 100s of lives (Kenya outbreak 2004–05, 150 known fatal cases)
- 4.5 billion people chronically exposed (estimate by US CDC)
  - Cancer
  - Immunosuppression
  - Stunting



# What are aflatoxins?

- Toxin produced by *Aspergillus* spp., mainly *Aspergillus flavus* and *Aspergillus parasiticus*
- Metabolic by-product from certain strains
- *Aspergillus flavus* toxin



<http://www.fda.gov/Food/FoodbornellnessContaminants/CausesOfIllnessBadBugBook/ucm070664.htm>

# Why is the toxin there?

- Fungi infect stressed crops pre-harvest, during harvest or during storage
- Especially susceptible crops: maize, groundnuts
- Optimum temperature 37°C (range 12-48°C)
- Mainly tropical disease



# Aflatoxins are a political issue

## DAILY NATION

### Kenya alert over 2.3m bags of bad maize

 SHARE  BOOKMARK  PRINT RATING ★★★★★



Farmers spread their maize to dry in Kibwezi. Researchers say spreading maize on the ground increases its contact with the soil, where the fungus that produces aflatoxins resides. Photo/FILE

By LUCAS BARASA  
Posted Monday, May 31 2010 at 18:44

## Kids at centre of toxic food saga are 270,000

By CATHERINE KARONGO | November 3, 2011



*School Children /FILE*

NAIROBI, Kenya, Nov 3 – The number of school going children feared to have consumed the aflatoxin contaminated Unimix during the Kenyans4Kenya initiative is more than 270,000 and not 60,000 as earlier thought.

Public Health Minister Beth Mugo said on Thursday that 726 schools had been supplied with the contaminated food at the time of the recall.

"My ministry in collaboration with the Kenya Red Cross Society and manufacturers are still recalling the consignment which was distributed irrespective of

whether it is suspected to be contaminated or not," the Public Health Minister said.

While issuing a ministerial statement in Parliament, Mugo blamed the Kenya Red Cross Society for failing to immediately inform the ministry about the contamination.

She said the ministry was notified of the contamination on October 6 by one of the manufacturers, Proctor & Allan.

# What is the problem?

- Aflatoxin one of the most potent carcinogens known
- Acute aflatoxicosis
  - Hepatotoxic
- Chronic exposure
  - Carcinogenic: hepatocellular carcinoma
  - Immunomodulation?
  - Stunting?

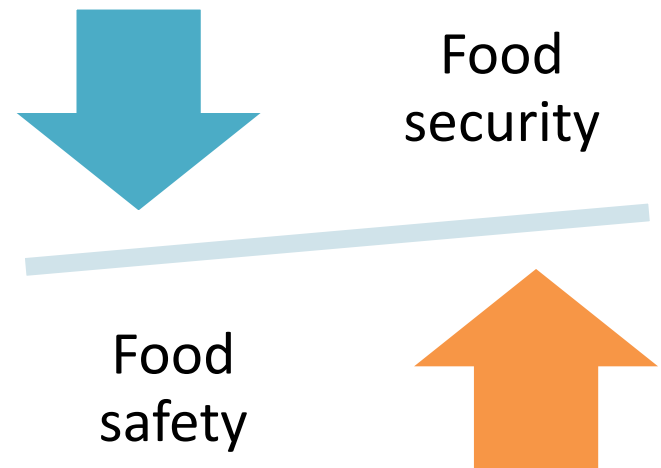
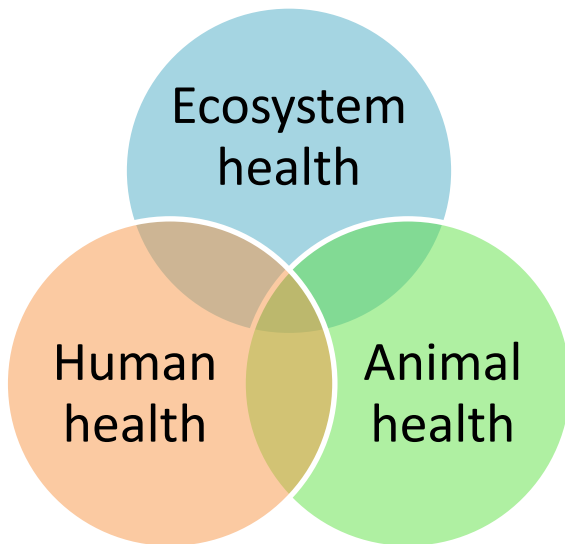
# Why is it so scary?

- Invisible toxin
- Odourless
- Heat-stable

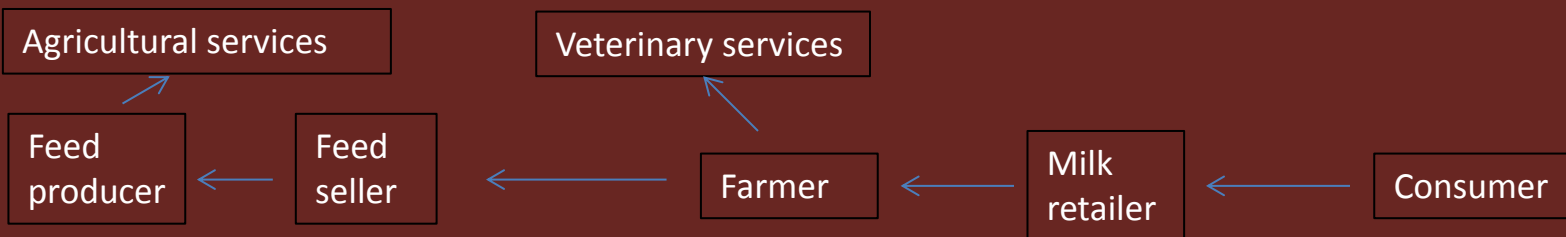


- And we are feeding it to our children

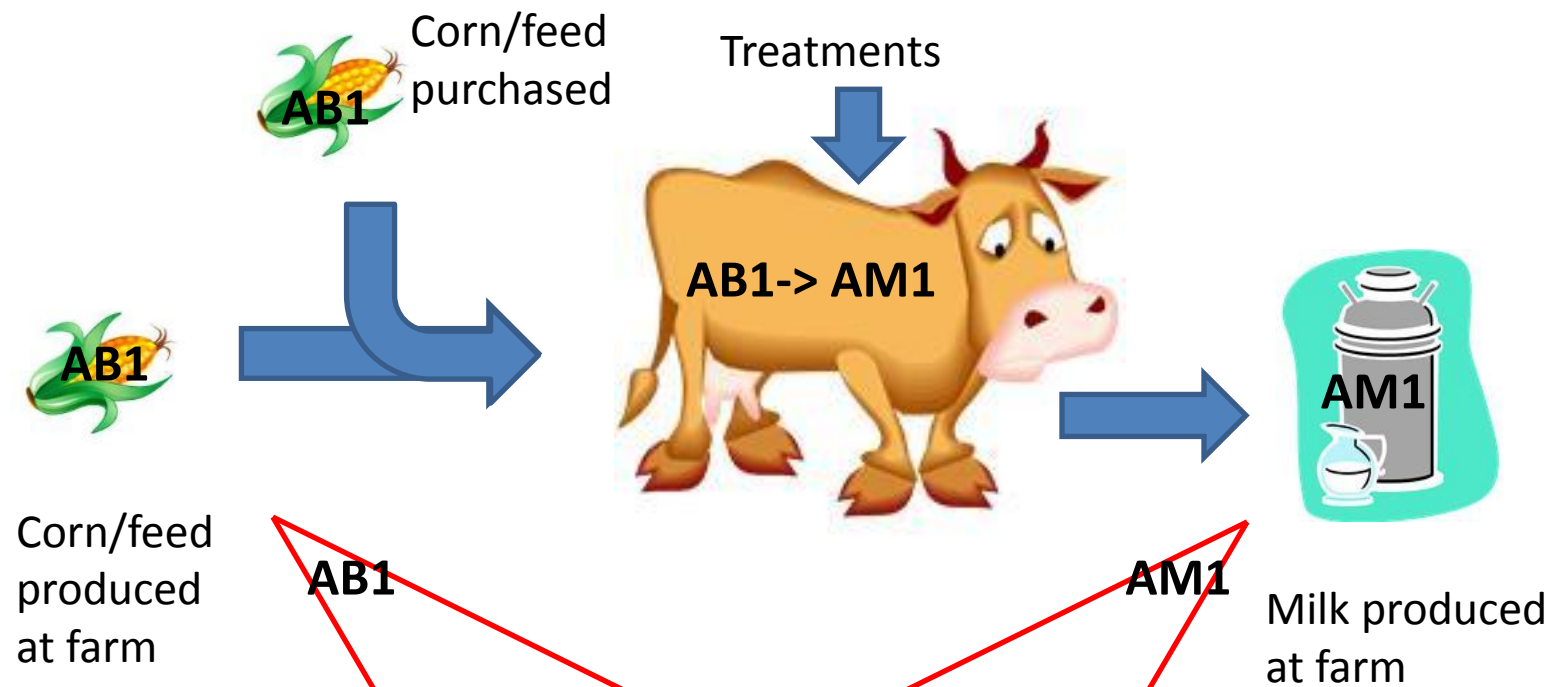
# Aflatoxins are a multi-disciplinary issue



Economic flow



Aflatoxin flow



Human exposure



Farmer



Consumer

# What promotes the fungal growth?

- Pre-harvest: damage by insects, draughts
  - Insects cause damage and are mechanical vectors
- Post-harvest: Poor storage conditions



Improper drying of grains - Different grains being dried on roadside with rains looming in the horizon. Photo by IITA

# The consequences of export barriers

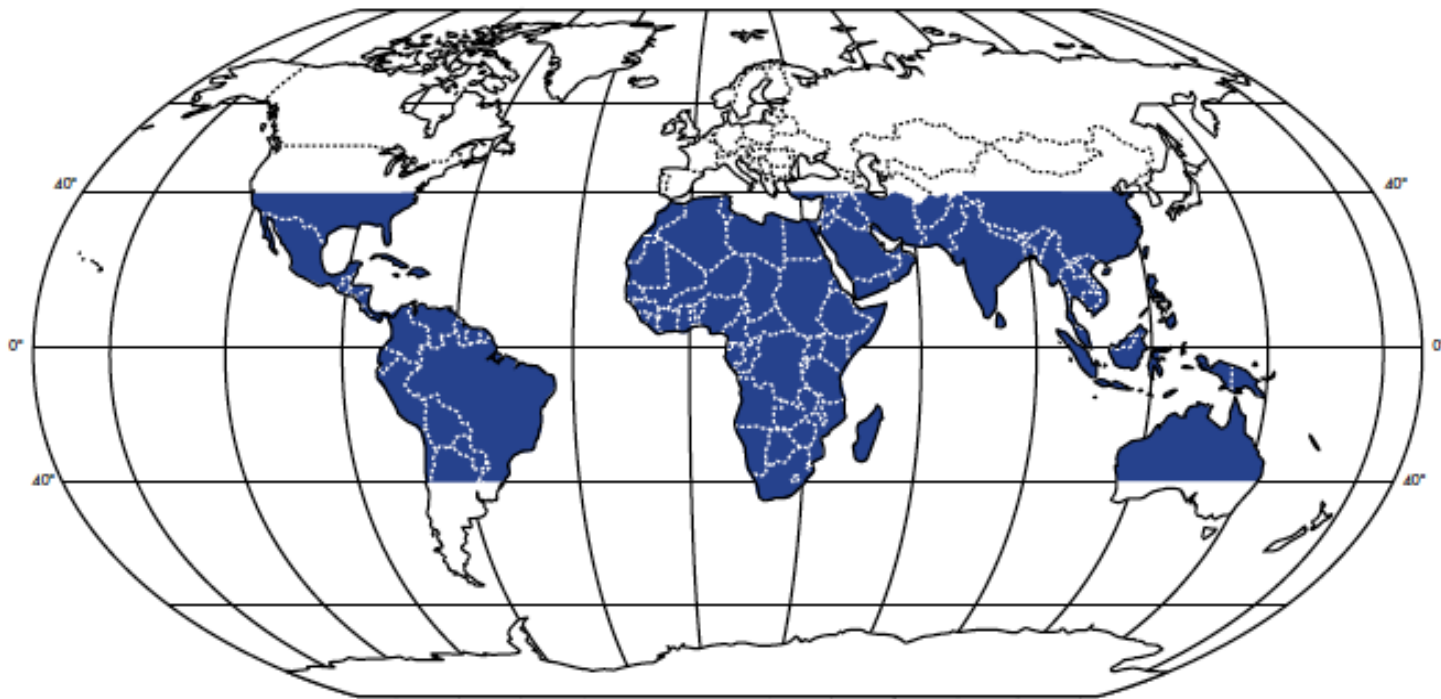
- The best products are exported
- The bad products are left to the national markets



Photo by IITA.

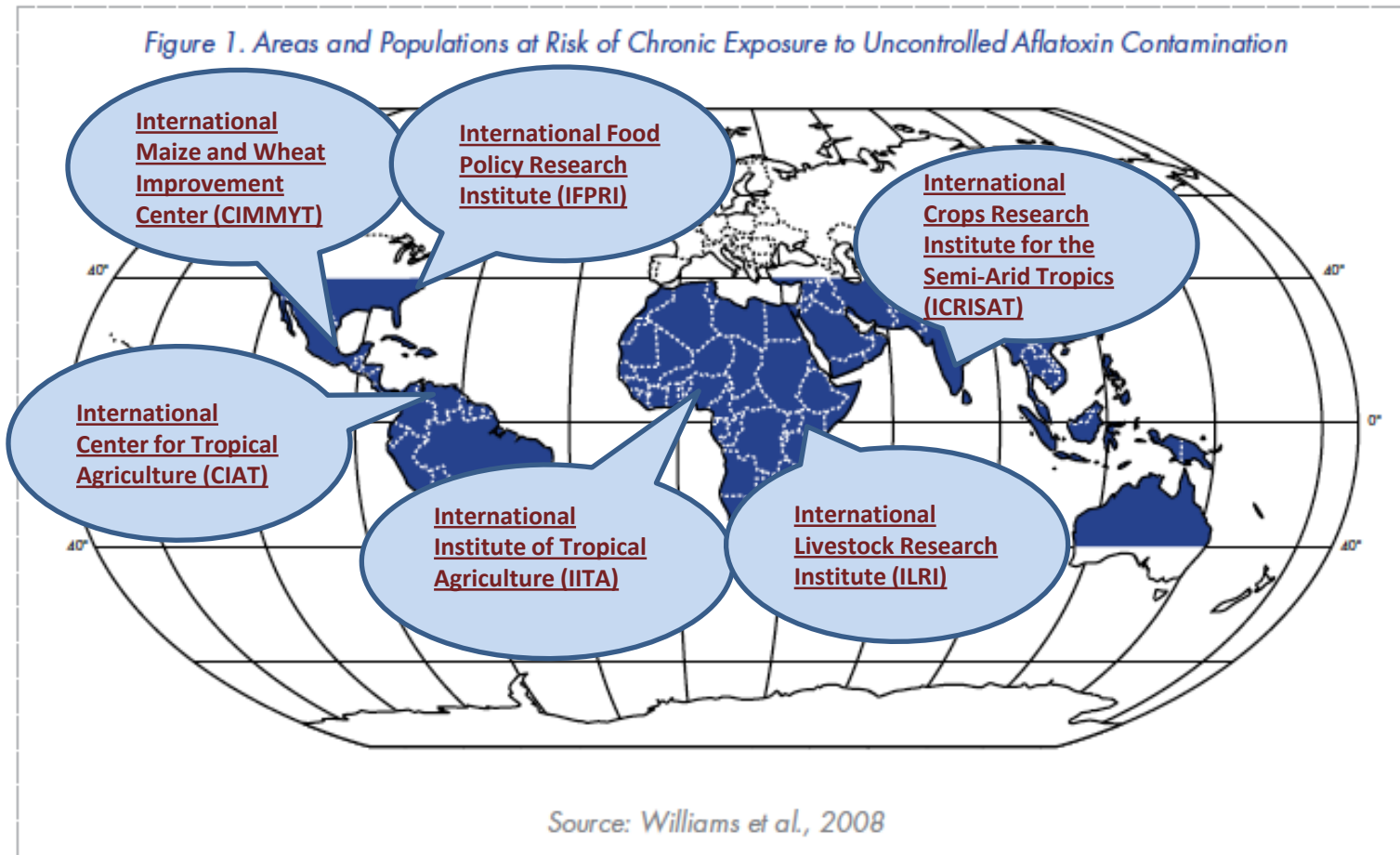
# Aflatoxins are a global issue

*Figure 1. Areas and Populations at Risk of Chronic Exposure to Uncontrolled Aflatoxin Contamination*



*Source: Williams et al., 2008*

# CGIAR are global institutes



# How can CGIAR approach this?

1. Bridging the knowledge gap
2. Diagnostics
3. Pre-harvest interventions
4. Post-harvest interventions
5. Handling aflatoxin contaminated products
6. Policies and standards

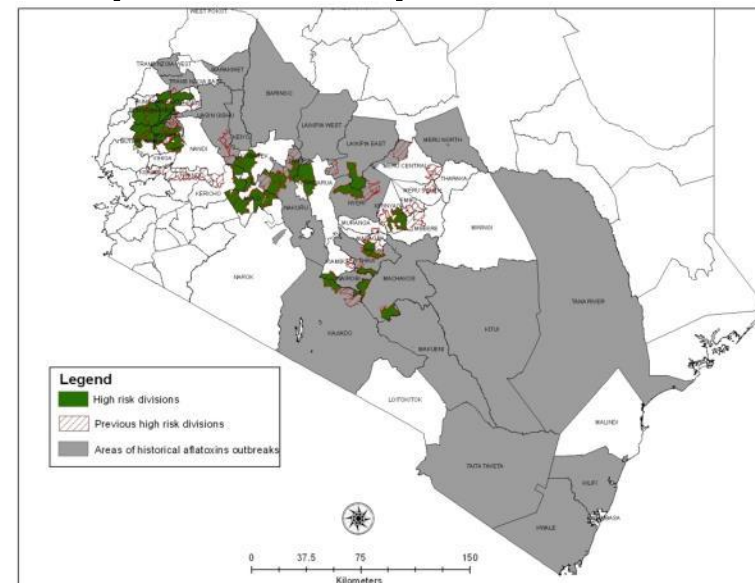
# Bridging the gaps in knowledge

## 1. Documenting occurrence of aflatoxins

1. Maize (CIMMYT, IFPRI, ILRI, IITA)
2. Groundnuts (ICRISAT, ILRI, IITA)
3. Milk (ILRI)
4. Animal feed (ILRI)

## 2. Risk mapping (ILRI, BecA-ILRI Hub, ICRISAT)

## 3. Risk assessment (ILRI)



# Diagnostics

1. Improved and cheaper diagnostics (ICRISAT, BecA-ILRI hub)



# Pre-harvest interventions

- Drought, insect and aflatoxin resistant maize (CIMMYT, IITA)
  - Genetically modified maize (Bt corn)
    - Saves 23 millions in the US
- Integrated pre-and post harvest interventions “Best practices” (ICRISAT)
- Atoxigenic strains (IITA)

Aflasafe

Dr Charity Mutege awarded World Food Prize 2013

# Post-harvest interventions

1. Grain storage project (CIMMYT)
2. Improved crop storage (ICRISAT)
3. Feasible post-harvest technologies (IFPRI)



# Kenya to mop up contaminated maize

By | May 10, 2010

NAIROBI, Kenya, May 10 – The government has announced that it will purchase contaminated maize from farmers in Eastern and Coast provinces in an attempt to stop the circulation of the deadly aflatoxin fungi in the market.

## Problems moping up: What to do with contaminated crops?

1  
iers

“We have directed the NCPB to buy back any contaminated maize either from individuals, retail stores or millers. We will install reliable aflatoxin test kits at all Cereals Board depots within one week,” said the PM adding that a taskforce would be formed to analyse the issues and recommend actions to be taken.

The PM was speaking after receiving a report from the cereals body on the toxic grains in the country which was undertaken in March after his office was told that the Agriculture Ministry might have purchased large quantities of the bad maize.

The contamination of grains is not new to Kenya and has in the past claimed lives as happened in 2004 when 150 people died after they consumed aflatoxin-infected maize. This time however, no deaths have been reported.

High humidity caused by continuing heavy rains has caused extensive damage to farmers' harvests in the two regions due to what has largely been attributed to limited knowledge on how to dry and store the grains. The grains that are believed to be highly contaminated are those harvested in the last few months during the on-going long rains.

# Handling aflatoxin contaminated products

1. Biological control with lactic acid bacteria (ILRI)
2. Mycotoxin binders (ILRI)
3. Consumer knowledge and willingness to pay  
(ILRI, IFPRI)

# What is done with mouldy food?

- Feed to chicken
- Feed to other animals
- Discard in pit, manure
- Mix with good crop and mill
- Wash, dry, re-cook

# What is done to mouldy feed?

- Discard for manure
- Keep feeding, or dry before feeding
- Dry and mix with new feed
- Burn (4 out of 54 groups)

# Standards and policies (ILRI, IFPRI, IITA)

## FDA limits

product or animal	total aflatoxin action level ( $\mu\text{g/kg}$ )
human food	20
milk	0.5
beef cattle	300
swine over 100 lbs	200
breeding beef cattle, swine, or mature poultry	100
immature animals	20
dairy animals	20

## National limits

nation	total aflatoxin standard in human food ( $\mu\text{g/kg}$ )
Australia	5
China	20
European Union (EU), harmonized	4
Germany	4
Guatemala	20
India	30
Ireland	30
Kenya	20
Taiwan	50

# Why we need to mitigate aflatoxin

**DAILY  NATION** Wednesday  
November 9, 2011

## Kebs tests showed Unimix was bad



Photo/FILE Families queue to receive relief food from the Kenya Red Cross Society at Lokichar in Turkana South District in the recent past.

# Conclusions

We need to approach from multiple angles

We need to use evidence

We must not forget the other hazards and mycotoxins

We need to cooperate

# Conclusions

There is no silver bullet to eradicate aflatoxins

A battery of interventions to provide safer food in a world full of food safety hazards!



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