

Measuring and mitigating the risk of mycotoxins in maize and dairy products for poor consumers in Kenya

WP5



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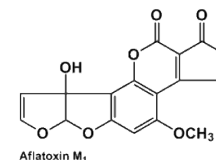
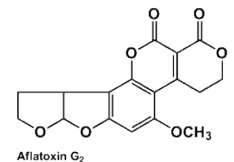
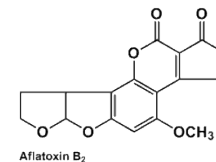
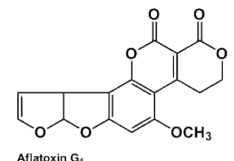
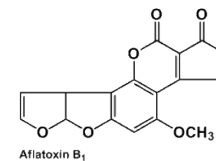
What are mycotoxins?

- When some moulds grow on crops, they produce toxic substances that can remain in the crops



Aflatoxins

- Toxic byproducts from *Aspergillus* fungi
 - Acute outbreaks can claim 100s of lives (Kenya outbreak 2004-2005 150 known fatal cases)
 - 4.5 billion people chronically exposed (estimate by US CDC)
 - Cancer
 - Immunosuppression
 - Stunting



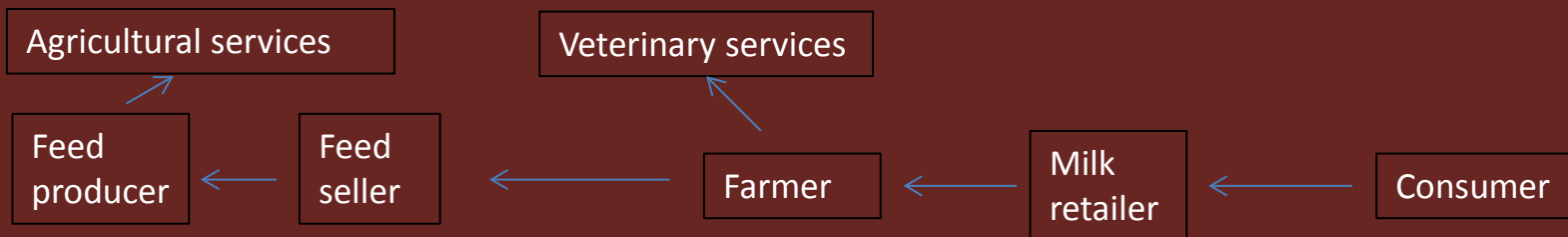
Global issue

- Estimated that total mycotoxin losses in the states are 1.4 billion USD annually
- Most countries have legislated limits to reduce exposure
 - EU limits of 4 ppb estimated to decrease African exports by 64% (670 million USD)
 - Many developing countries are not enforcing the laws

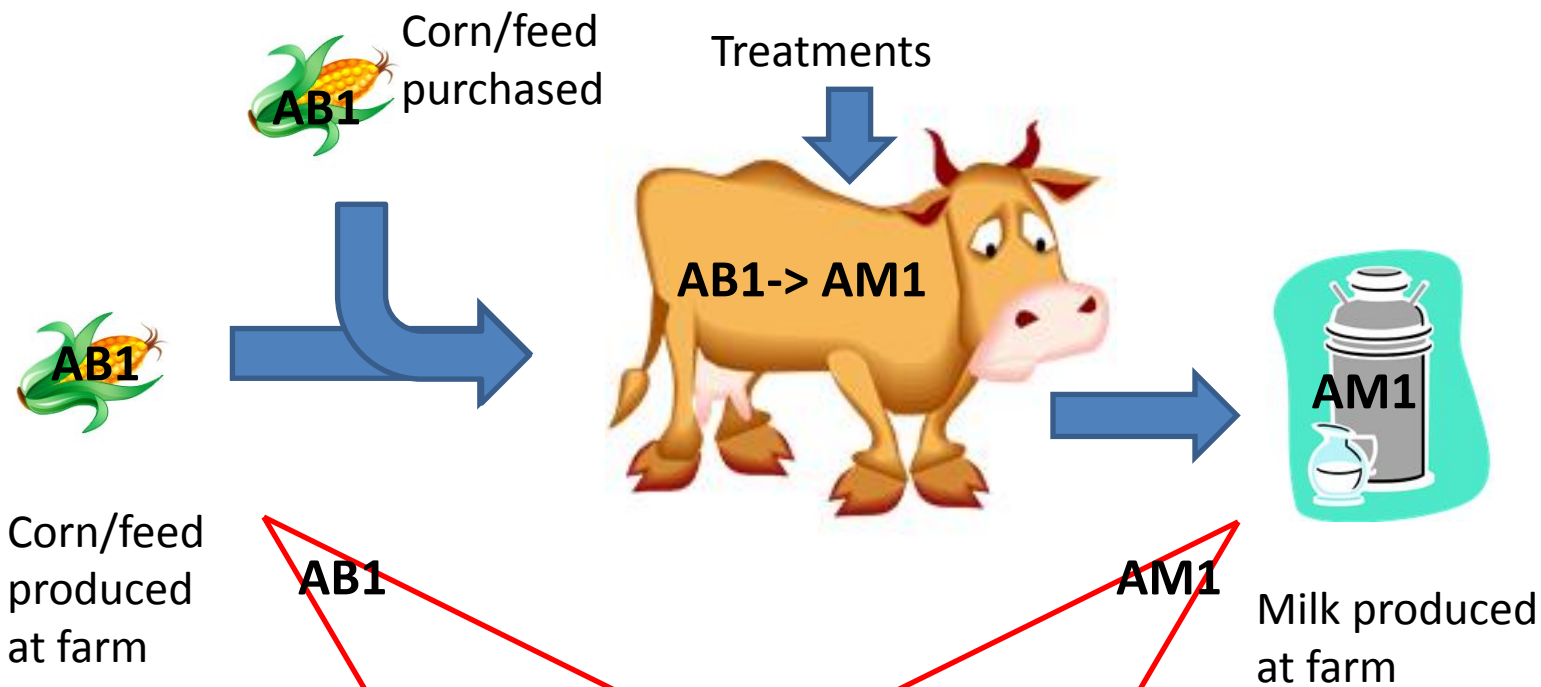
Objectives for this project

1. *To assess the economic cost and risk to human health associated with mycotoxins in the Kenyan feed-dairy chain -ILRI*
2. *To identify existing and develop new technologies and practices for mitigating the risk of mycotoxins in the Kenyan feed-dairy chain. – MTT/Luke*
3. *To assess the effectiveness of a package of low cost post harvest technologies and practices in reducing aflatoxin contamination in maize, and subsequent aflatoxin exposure in children - IFPRI*
4. *To build evidence and capacity among policymakers, implementers, farmers to reduce the risk of human and animal exposure to mycotoxin contamination -ALL*

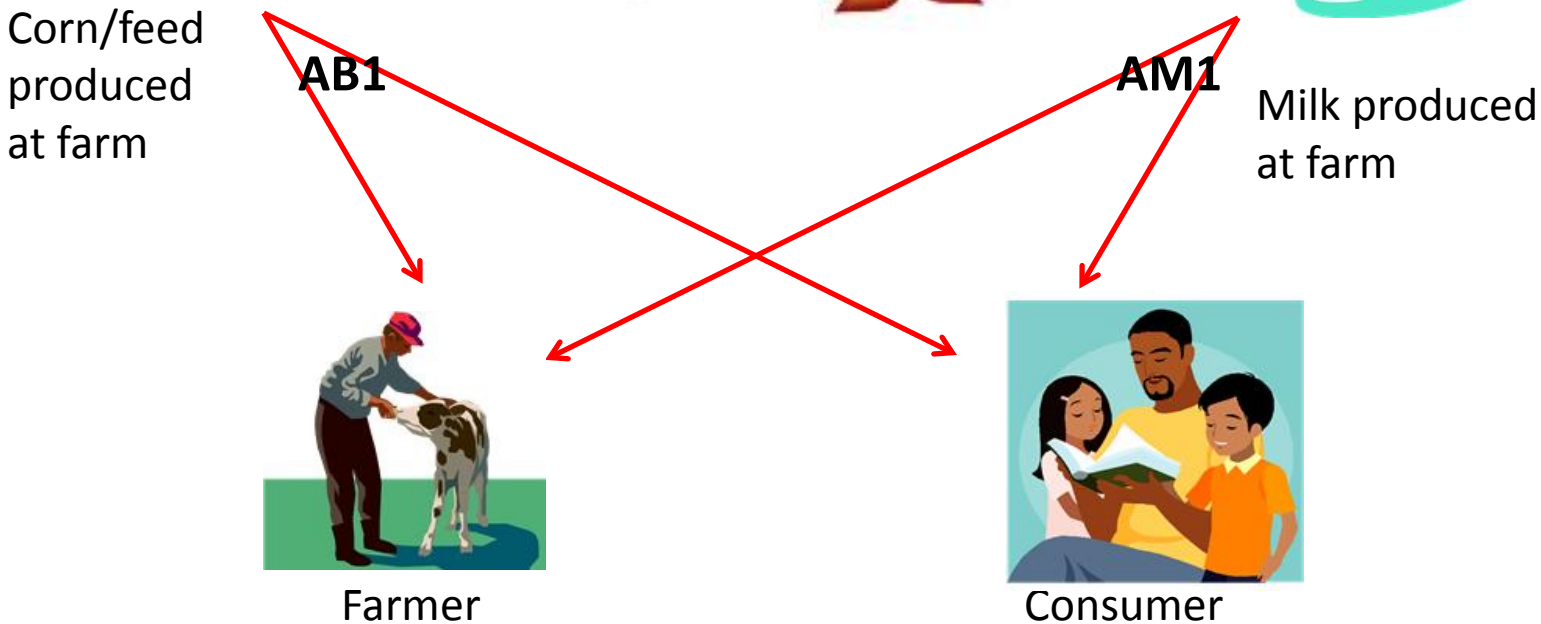
Economic flow



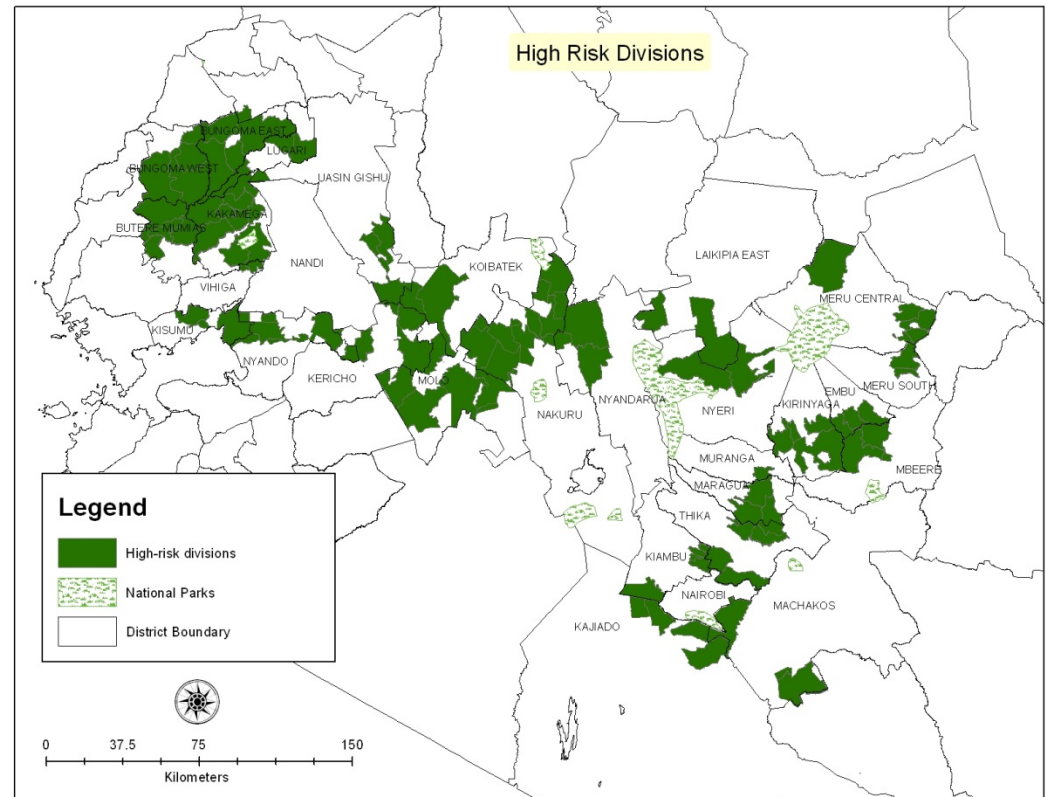
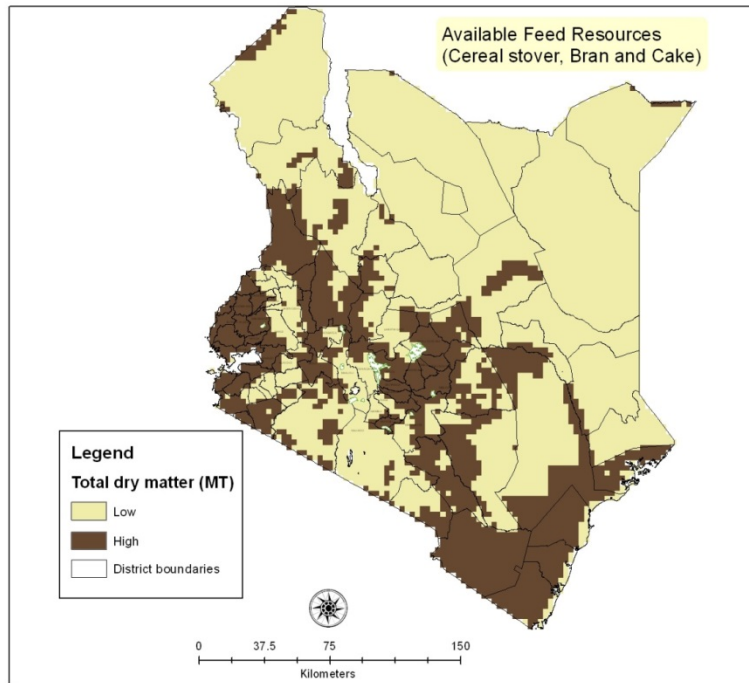
Aflatoxin flow



Human exposure



1 Assess Dairy Risk—ILRI



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Focus group discussions

- Women greater role in deciding what to feed cattle
- Common to feed mouldy food to livestock
- Men and women share more decision making than literature suggests
- Men and women disagree which gender has responsibility



1 Assess Dairy Risk—ILRI

Willingness to pay study: 600 urban consumers

- Low income areas:
 - 55% know of aflatoxin
 - 53% think aflatoxin is a serious threat
- Middle-high income:
 - 80% know of aflatoxin
 - 32% think aflatoxin is a serious threat
- All income willing to pay a premium aflatoxin assured milk

1 Assess Dairy Risk—ILRI

- Dairy feed AFB1 levels up to 9,661 ppb (legal limit is 5), 25% to 100% above level.
- Milk samples up to 6,999ppt AFM1
- Up to 26% above 50ppt (WHO/FAO limit)



1 Assess Dairy Risk—ILRI

Milk exposure

- Of raw milk sold in Dagoretti, 55% of samples exceeded 50 ppt
- 41% of children in Dagoretti and Korogocho were stunted
- Milk AFM1 associated with stunting



2 Technologies for managing risk-Luke

Biocontrol of aflatoxin

- Developing microbiological method for controlling aflatoxin in maize and and dairy products.
- Lactic acid bacteria (LAB) isolated from fermented maize and milk products prepared traditionally in Kenyan rural households.
- Out of 200 LAB isolates three inhibited strongly the growth of aflatoxin producing fungi. These isolates were identified as *Lactobacillus plantarum*.
- Testing of aflatoxin binding in progress

2 Technologies for managing risk- Luke

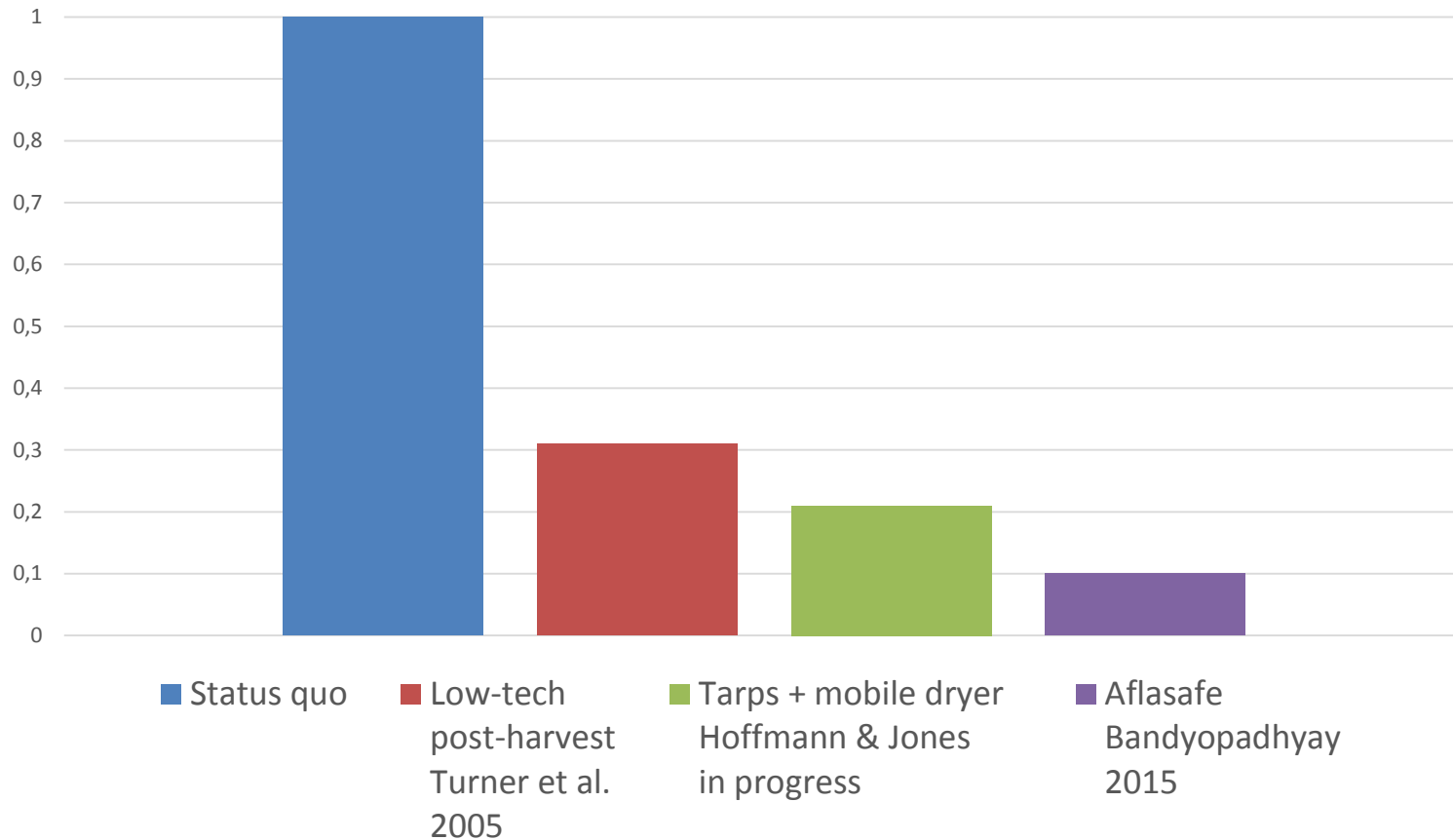
Prediction of aflatoxin risk in maize

- Weather data-based model being developed for predicting risk of aflatoxin formation in maize.
- Gridding system introduced to Kenya Meteorological Department (KMD).
- Preliminary aflatoxin and weather data compiled and analyzed.
- Validation of the model will be carried out in FoodAfrica II in two areas of Kenya.

3 Adoption of post-harvest technologies - IFPRI

On-farm technologies work

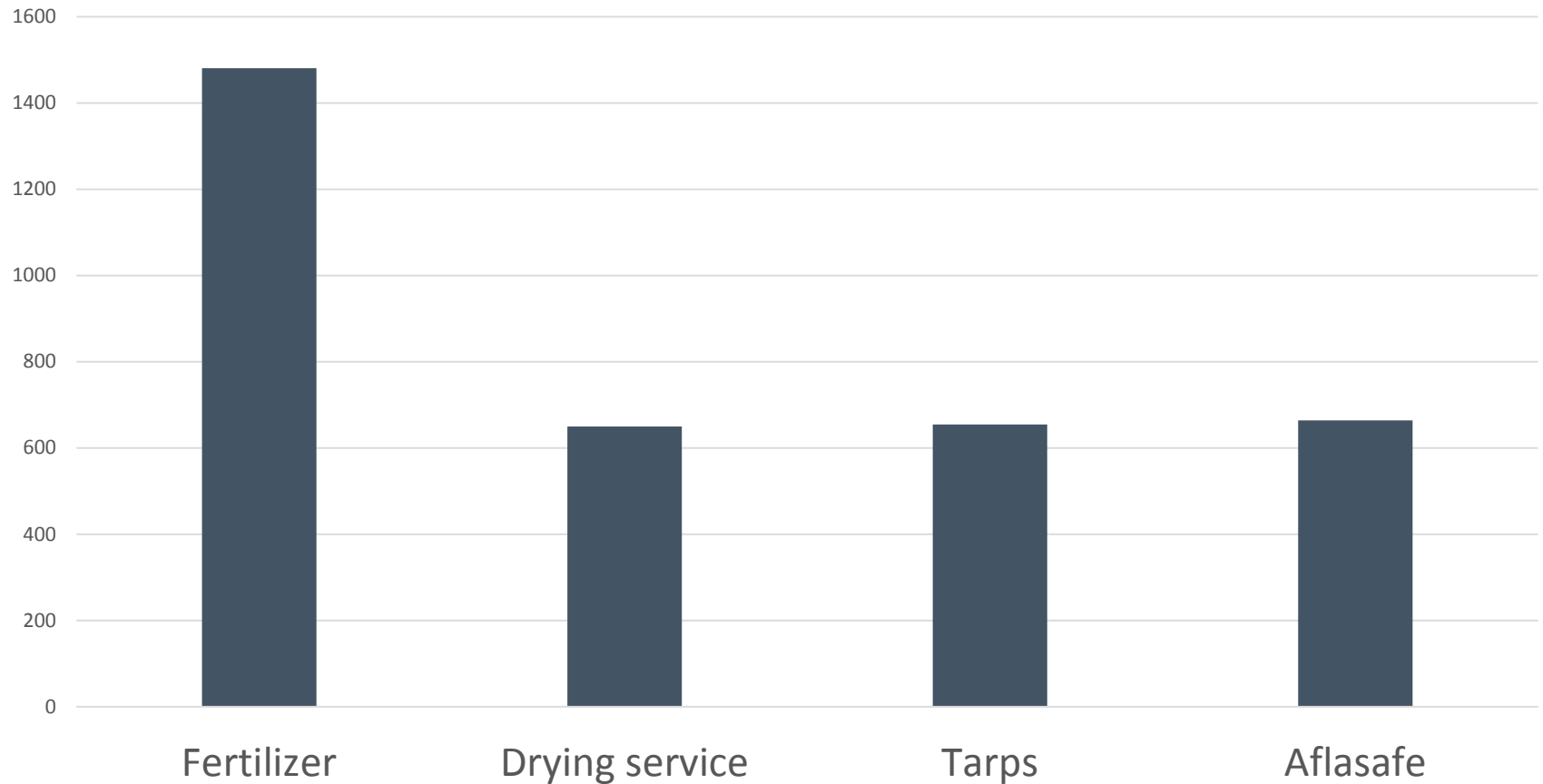
Mean aflatoxin, relative to status quo



3 Adoption of post-harvest technologies - IFPRI

But farmers must invest effort & cash

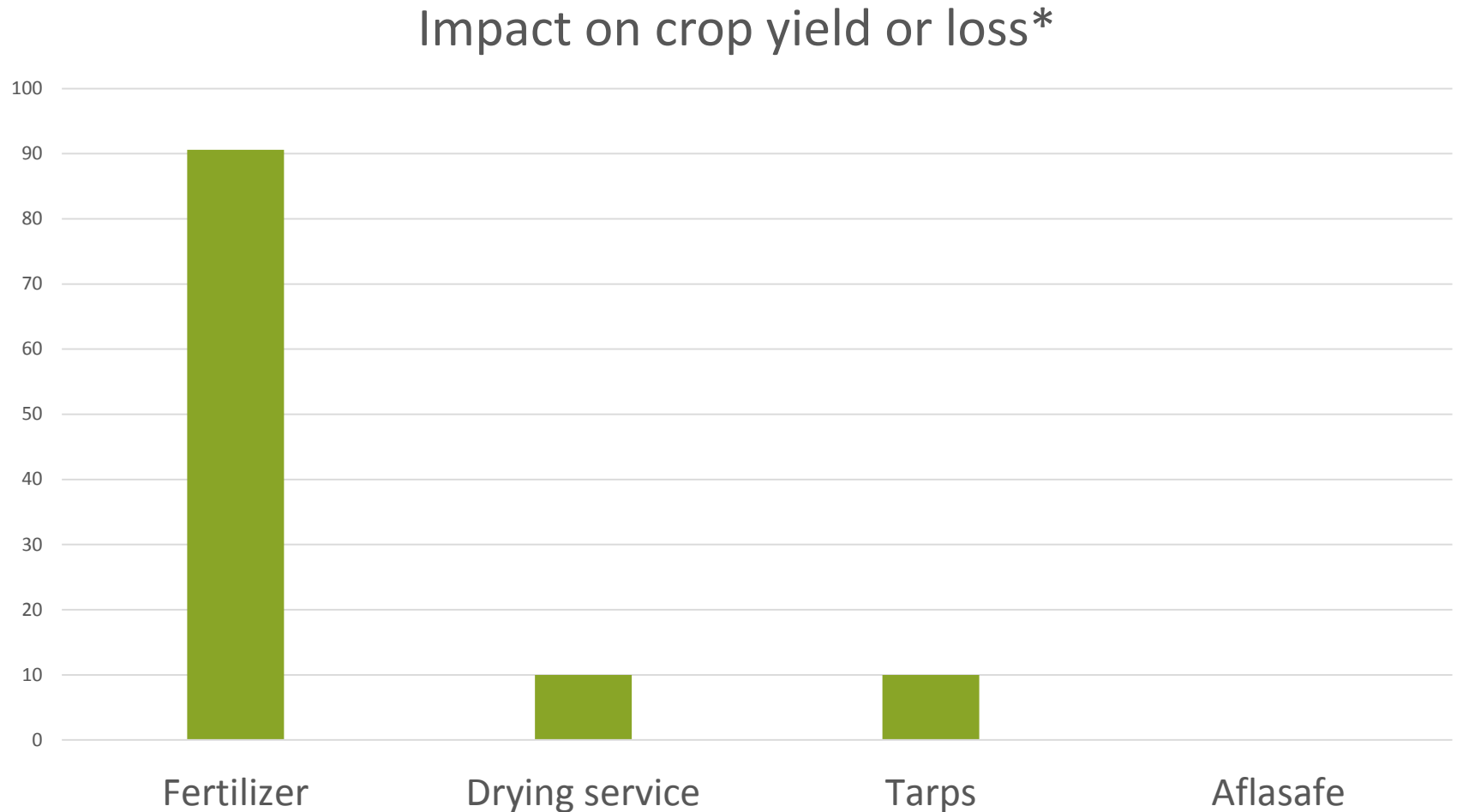
Cost of technology per acre of maize*



* Based on median maize yield of 540 kg / acre in Eastern Kenya; tarps assumed to last 2 years

3 Adoption of post-harvest technologies - IFPRI

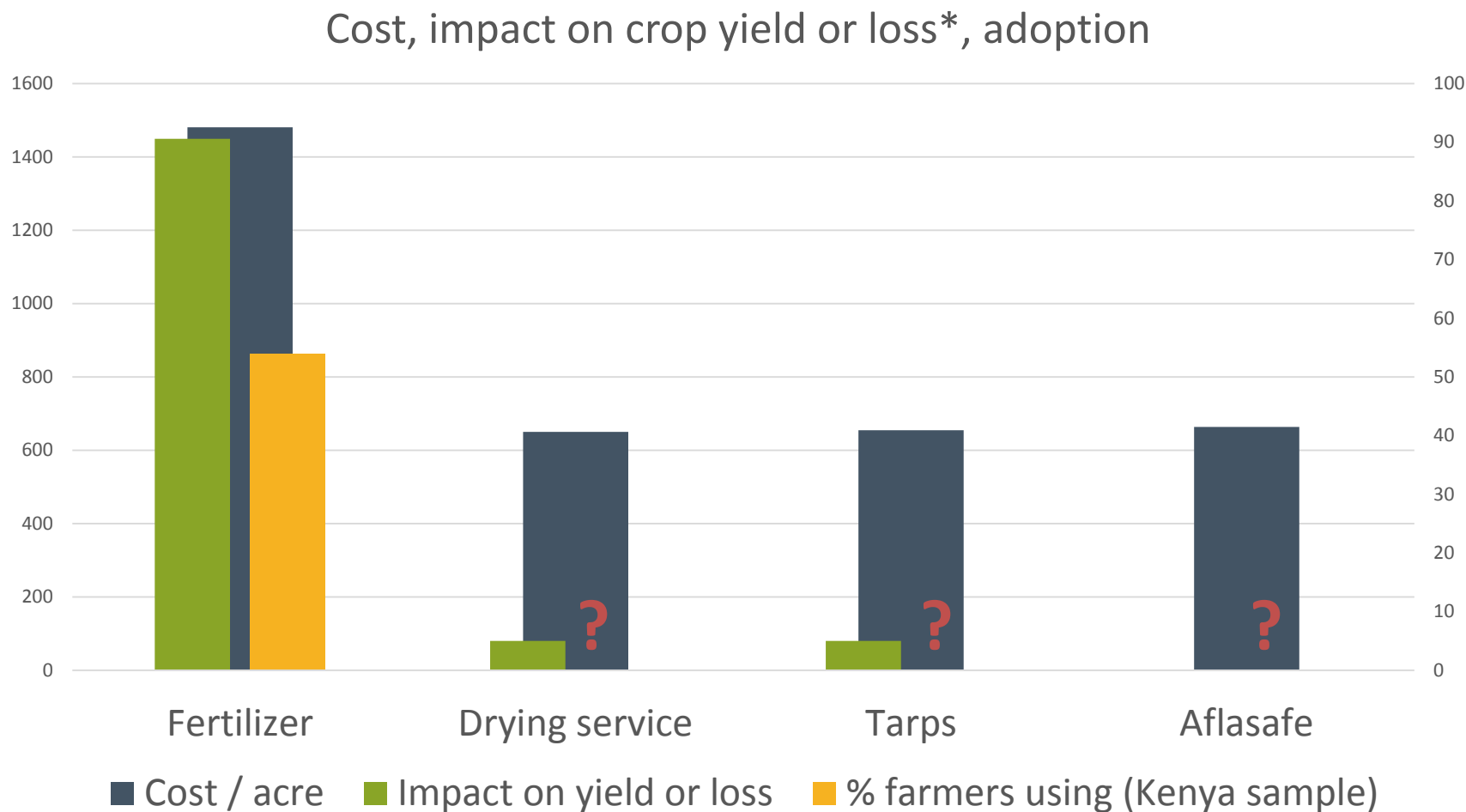
For little if any observable benefit



*Impact of fertilizer based on Duflo et al. 2008; impact drying service and tarps is illustrative

3 Adoption of post-harvest technologies - IFPRI

Farmers may be reluctant to adopt



* Costs based on median maize yield of 540 kg / acre in Eastern Kenya; tarps assumed to last 2 years. Impact of fertilizer based on Duflo et al. 2008; impact drying service and tarps is illustrative

3 Adoption of post-harvest technologies - IFPRI

Aflatoxin control is a health behavior

- People under-invest in preventive health
 - Immunization, mosquito nets, water treatment
 - Health inputs often provided free of charge
- Adoption of aflatoxin control for health alone is likely to be limited without subsidies
- Even if inputs are free, prevention takes effort

3 Adoption of post-harvest technologies - IFPRI

Markets incentives for safe food

- Formal sector feed and food processors desire aflatoxin-safe inputs
- Important to link farmers directly with these buyers for pass-through of price incentive
- Less effective for pure or primarily subsistence farmers
- Subsidies and linking farmers to premium markets are complementary strategies

3 Adoption of post-harvest technologies - IFPRI

Study setting: maize in Eastern Kenya & technologies

Sample: 660 maize farmers



- 50% given tarps, offered mobile drying service
- Randomly assigned subsidy level (0, 43%, 100%)
- Randomly assigned market incentive (yes or no)

3 Adoption of post-harvest technologies - IFPRI

Scale of prices and incentives

Market price 30 USD per 100 kg bag

Drying price:

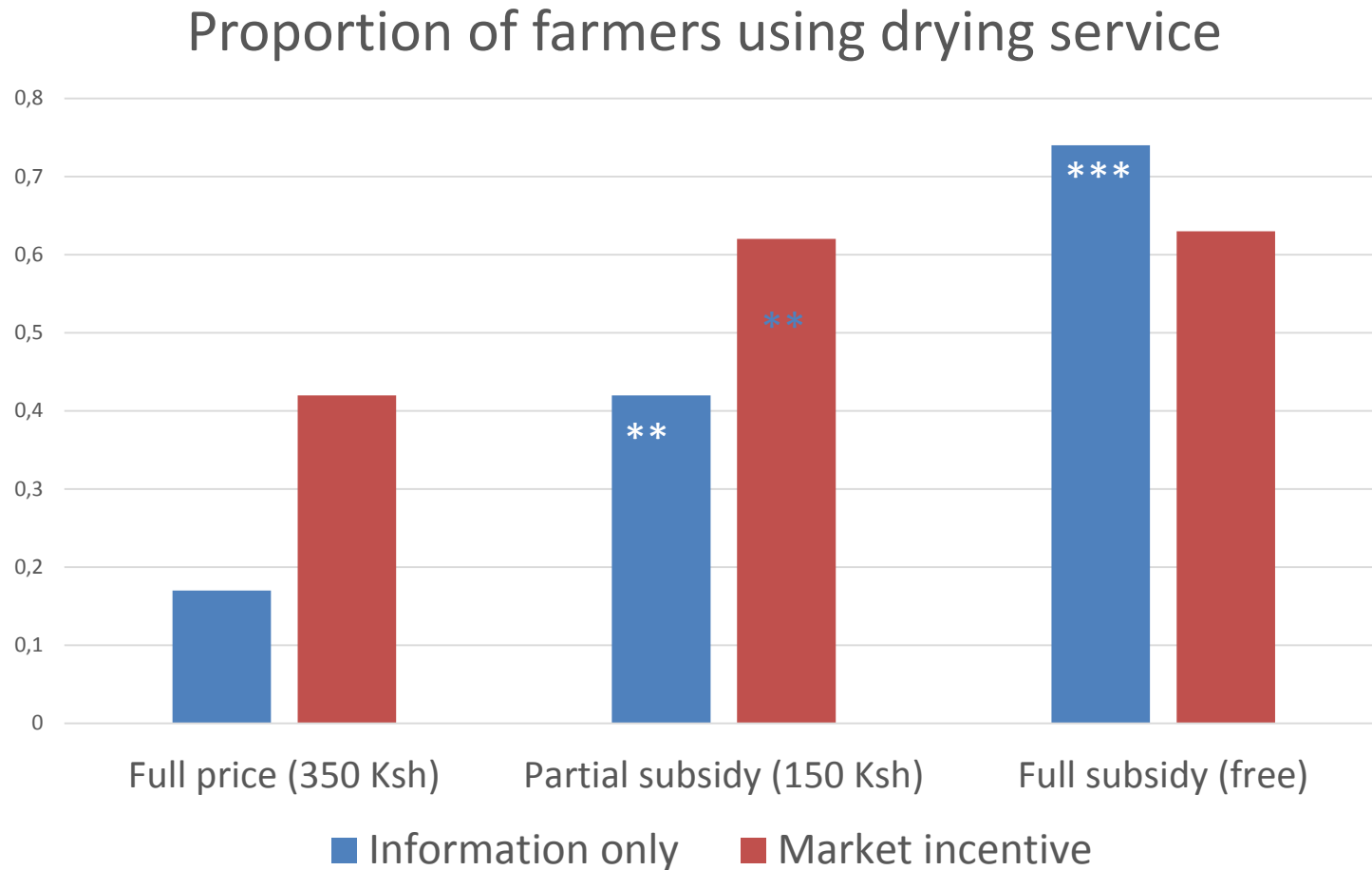
Treatment	Cost per bag	% of value
Full price	USD \$3.45	12%
Partial subsidy	USD \$1.48	5%
100% subsidy	USD \$0	0%

Premium for aflatoxin-safe maize

- Equivalent to 22% premium for median (100 kg) seller
- Formal sector premium ~29%

3 Adoption of post-harvest technologies - IFPRI

Subsidy, price incentive both effective



* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. White is comparison against next highest price in same incentive treatment; blue against info only. Incentive vs info in full price p -value=0.105.

4 To build evidence and capacity to reduce the risk of human and animal exposure to mycotoxin

- **Policy impact pathway**
 - ILRI & IFPRI Edited 2020 series of policy briefs on cutting edged aflatoxin science
 - ILRI asked to write technical packages for submission to East African Community
- **Media**
 - ILRI/IFPRI/IITA Press conference & journalist round table
- **Capacity development**
 - 4 PhD students, 2 female, 2 male
 - 2 master students, 1 male, 1 female
- **Farmer training**
 - Hundreds of farmers trained
 - >80% reported their practices changed after training

The future

Harnessing markets for food safety



Farmers

- Information
- Inputs
- Price incentives



Processors

- Build testing capacity
- Independent verification testing



Consumers /
regulator

- Create awareness
- Enforce standards

The future

The legacy of FoodAfrica

Finnish investments made important contributions

Research for development continuing:

Flagship program on food safety with focus on aflatoxins important part of next phase for CGIAR



Thank you for your attention
and your support to food safety
in Africa!

Thanks to all participants and
students!

