



RESEARCH
PROGRAM ON
Agriculture for
Nutrition
and Health

LED BY **IFPRI**

Second Joint CGIAR Meeting on Mycotoxins

9-11 October 2013

Enashipai, Naivasha, Kenya

Report prepared by Delia Grace



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Meeting summary

On 9-11 October 2013 participants from five CGIAR centres met at Naivasha in Kenya to share about their current activities related to mycotoxin research and to plan for how these different activities might contribute to the next phase of the CGIAR Research Program on Agriculture for Nutrition and Health (A4NH) mycotoxin research portfolio.

The meeting was attended by representatives from the International Maize and Wheat Improvement Center (CIMMYT), the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), the International Institute of Tropical Agriculture (IITA), the International Food Policy Research Institute (IFPRI) and the International Livestock Research Institute (ILRI) and the Biosciences eastern and central Africa (BeCA). Scientists presented their current mycotoxin research activities, the research gaps and opportunities they see, and areas for development. In addition, IITA presented on Biocontrol using atoxigenic *Aspergillus flavus* and ILRI presented on risk analysis as the current gold standard for assessing, managing and communicating food safety. All presentations are available at: <http://aghealth.wordpress.com/presentations-at-the-second-joint-cgiar-meeting-on-mycotoxins/>

The group agreed that mycotoxins were a key area for food safety and trade in Africa; that it was important to co-ordinate CGIAR activities across A4NH; that moving into a second phase of A4NH emphasis was needed on developing strong impact pathways that linked research with development outcomes.

To this end, the group established three working groups for CG mycotoxin research:

- Evidence for risk and risk mitigation
- Diagnostics for use
- Population biology for control

Members of the working groups were as follows (with centers free to suggest others or changes):

- Evidence – Delia Grace, Vivian Hoffmann, Farid Waliyar, other tbd
- Diagnostics – Fen Beed, Jagger Harvey, Hari Sudini, George Mahuku, Jef Leroy (tbc)
- Population Biology - Fen Beed, Jagger Harvey, Hari Sudini, George Mahuku, Benoit, Moses Osiru

Summary of some of the next steps

- Communication to be facilitated by DG, RB, FW
- Progress updates to be circulated each month: Amanda to set up group email covering both Mycotoxin Focal Points and Working Group Members
- Data sharing would be set up through Team space and Drop Box: Amanda to help with communication
- The next meeting of the Mycotoxin Focal Point Group is provisionally planned for 20-21 March Washington DC. A4NH will support participation by one person per center.



Ongoing mycotoxin research activities

Centers reported on their current research activities and interests.

BecA

BecA is a shared agricultural research and biosciences platform located at and managed by ILRI in Nairobi, Kenya. They have one major project on aflatoxins and some smaller collaborations. Their interests are below and further details are found in the online report ([BecA activities](#))

- Establishing a diagnostic platform and developing novel diagnostics
- Characterising maize for resistance
- Characterise maize fungi
- Develop predictive modelling for aflatoxins
- Maize sorting

Countries: Kenya, Tanzania

CIMMYT

CIMMYT leads the CGIAR Research Program on Maize and are interested especially in maize where aflatoxin is an important problem.

- Aflatoxin resistant maize varieties

ICRISAT

The program of ICRISAT focuses on groundnuts, an important crop in Africa and Asia and one that is especially prone to aflatoxin contamination. Further details are found in the workshop online report ([ICRISAT activities](#))

- Diagnostic assays for groundnut crops and human exposure
- Integrated control of aflatoxins
- Aflatoxin resistant ground-nut varieties
- Biological management of aflatoxins
- Risk factors for contamination and mapping hot spots
- Development of a database on prevalence

Countries: Mali, India, Malawi



IFPRI

IFPRI has research interests around economic and evidence aspects of aflatoxins. They have one major project and some smaller collaborations. A summary of ongoing work from a recent seminar is online ([IFPRI activities](#)).

- Impact of aflatoxins on stunting in children
- Impact of management strategies on aflatoxin control
- Consumer demand for aflatoxin-tested and certified maize flour

Countries: Kenya

IITA

IITA has a multi-faceted, multi-million dollar, research portfolio, with biocontrol featuring as a key technology upon which other technologies can be integrated. Further details are found in the workshop online report ([IITA active projects](#))

- Biological control of aflatoxins in maize, and all other aflatoxin vulnerable crops, to provide protection from field to store
- Integrated control of aflatoxins
- Aflatoxin resistant maize varieties
- Quantifying mycotoxin contamination in maize, cassava and beans
- Cost benefit analysis and sensitization of stakeholders
- Market conditions for aflatoxin free maize
- Taking lead in drafting of technical papers in key areas across health, agriculture & trade
- Formulation, adoption and dissemination of policies and standards

Countries: Burkina Faso, Burundi, Ethiopia, Ghana, Kenya, Mali, Mozambique, Nigeria, Rwanda, Senegal, Tanzania, Uganda and Zambia

ILRI

ILRI has research interests at the animal and human health interface of aflatoxins. They have one major project and smaller collaborations. A summary of ongoing work from a recent seminar is online ([ILRI activities](#))

- Health risk and economic assessment of aflatoxins in the dairy chain
- Willingness to pay for aflatoxin free milk
- Aflatoxin exposure of animals in east Africa
- Feed trials on effects of aflatoxins on pigs fed local diets
- Biological control of aflatoxins in foods through lactic acid bacteria
- Mapping aflatoxins

Countries: Kenya, Tanzania, Ethiopia, Uganda, and Vietnam

Areas of mycotoxin research interest

The following table shows the areas of interests in the materials provided by the different groups when developing the Food Safety Flagship and updated before this meeting

		Beca	CIMMYT	ICRISAT	IFPRI	IITA	ILRI
	Food Commodity of interest	All	Wheat	Peanut	All	Maize	All
Technical platforms	Population biology of fungi	X				X	
	Resistant varieties for aflatoxins	X	X	X		X	
	Laboratory infrastructure	X		X		X	
Risk Assessment	Risk profiles based on in-depth assessment		X	X			
	National prevalence studies and risk assessments	X		X		X	X
	Economic assessment		X		X	X	X
	Mapping aflatoxin	X	X	X			X
Risk Management	Identify and characterize incentive based control options	X		X	X	X	
	Test incentive based control options	X		X	X	X	X
	Biocontrol and other control technologies	X		X		X	X
	Diagnostic assays for aflatoxins	X	X	X		X	X
	Alternative use of contaminated materials					X	
Communication	Actor KAP/Awareness rising	X		X			X
Policy Engagement	Situational analysis of policy					X	X
	Policy model analysis				X		
	Policy engagement				X	X	X
	Standards for food safety	X		X	X	X	X

Biocontrol

Fen Beed of IITA also presented a summary of the theory behind this technology and progress to date to address knowledge gaps of some of the participants



Update on additional CRP A4NH funded activities

CRP A4NH was able to obtain additional funding for aflatoxins in 2013/14. This was used to support cross-center activities and scoping of new areas of work. A brief update was provided by John McDermott and Delia Grace.

The following activities were undertaken by IFPRI:

- A review of the status of aflatoxin research and aflatoxin implications on human and animal health and food processing with special relevance to India (RP Thakur, ICRISAT and Ramesh Bhat & Vasanthi Siruguri, NIN)
- A review on aflatoxin as a public health challenge (Manish Kakkar, PHID)
- A mapping aflatoxin contaminated maize value chain (TNANUVAS and GADVASU)
- An assessment of the impact of aflatoxin on maize and groundnut trade (Rajesh Mehta, RIS)

An initial draft of the review of aflatoxins is available. The other reports are ongoing and will be available late 2013/early 2014.

A workshop proposing the way forward on aflatoxin research for development for India is also proposed with participation from IFPRI, IITA, CIMMYT, ILRI, DMR, TNANUVAS, GADVASU & PHID.

The following activities were undertaken by ILRI:

Aflatoxin mapping

A systematic literature review was undertaken following PRISMA guidelines to capture information on aflatoxin prevalence, risk factors and control. 23 databases were searched and an initial 2,500 papers identified. After screening, 412 were retained for data extraction. A first draft of the database is available. In addition, expert opinion and grey literature were reviewed and data still be extracted. Data is being analyzed but initial results reveal high prevalence: over 100 studies were retrieved on AFM1 in milk and nearly 30% of samples exceeded EU limits and several studies in sub-Saharan Africa and Asia with over 90% of samples exceeding EU limits. A second database of AFB1 prevalence is being assembled, with almost 100 studies entered. While data entry is still ongoing in this database, early results show that studies of maize, groundnuts and animal feeds with more than 40% of samples exceeding FAO/WHO limits. The database will be complete in late 2013 and associated maps produced in 2014.



Science Council Bonn

On 23 and 24 September, the CGIAR Science Forum 2013 on 'Nutrition and health outcomes: targets for agricultural research' featured a parallel session on food safety. It was organized by Delia Grace from the International Livestock Research Institute as part of the CGIAR Research Program on Agriculture for Nutrition and Health (A4NH). The session drew on examples of aflatoxin control as an example of agriculture-based interventions for human health. The aflatoxin challenge was introduced by a presentation from Fen Beed and used as a focus to bring together and assess five current approaches to mitigation:

- Breeding aflatoxin-resistant maize: George Mahuku, CIMMYT
- Biological control of aflatoxins: Peter Cotty, University of Arizona
- Integrated management of aflatoxins in maize & groundnuts: Ranajit Bandyopadhyay, IITA
- Genetic enhancement of groundnuts to resist aflatoxins, Hari Upadhyaya: ICRISAT
- Integrated groundnut aflatoxin management: Moses Osiru, ICRISAT

These were discussed by an 'investors panel' and the audience:

- Investors panel: Tom Randolph (ILRI); Laurian Unnevehr (IFPRI); Wycliffe Kumwenda (NASFAM)
- Facilitation: Peter Ballantyne (ILRI)

(Several centers paid for participants to attend: IITA, IFPRI, ILRI, ICRISAT: in addition the Science Council supported 3 participants)

Second joint CGIAR meeting on aflatoxins

The meeting on aflatoxins documented in this report and hosted by ILRI was also supported through additional CRP A4NH funding. The funding covered costs of attendance by 2-3 participants by center; in addition some centers funded the attendance of additional scientists with their own resources.



Identification of gaps and research opportunities

As a brainstorming activity, each group discussed key research gaps and opportunities to address them. This generated a range of opportunities and mutual interests.

	Opportunity	Centers with interests	Other partners	Scale
Evidence on impacts	Impacts of aflatoxin on malnutrition and stunting	ICRISAT ; IFPRI; BECA; ILRI; IITA	PACA; PMIL; NARS	1-2 m\$
	Use animal models to evaluate impact of aflatoxins on stunting (animal & human)	ILRI ; IFPRI; ICRISAT	ARI	0.5 m \$
	Whole diet assessment of aflatoxin exposure	ILRI ; ICRISAT; IITA; IFPRI	ARI	1-2 m\$
	Interaction of toxins, malnutrition, zoonoses and stunting	ILRI ; ICRISAT; IITA; IFPRI	ARI	10 m
	Impact of aflatoxins on intensive livestock and options for control	ILRI ; IITA;	NARS; ARI	1-2 m\$
	Characterising groundnut value chains for aflatoxins	ICRISAT ; IFPRI;	NARS; FA; PS	1-2m\$
Technical platforms	Technical platforms for underlying science	IITA ; ILRI, ICRISAT, IFPRI, CIMMYT, IITA	PACA, EAC, COMESA, PS, STDF, USDA, EU, NARS,	
	Understand microbial population dynamics	Beca ; ICRISAT; IITA	ARI; NARS	
	Develop rapid affordable diagnostics	ICRISAT ; ILRI; Beca	NARS; PMIL	1-2 m \$
Control	Biocontrol	ICRISAT; CIMMYT; ILRI; IITA	NARS	1-2 m \$
	Identify critical control points for aflatoxins in food and feed	ICRISAT ; ILRI ; Beca		1-2 m \$
	Small-scale decontamination of aflatoxins	Beca ; ICRISAT; IITA;	ARI; NARS	
Demand for control	Technology & price interventions to decrease peanut risk in Ghana	IFPRI	ARI	
	Aflatoxin testing in food school programs in Kenya	IFPRI	ARI; NARS	
	Consumer demand for aflatoxin-safe certified maize in Kenya	IFPRI	ARI; PS	
	Commercialization of pathways for technology implementation	IITA ; IFPRI; ILRI; CIMMYT	COMESA; PS	
Enable	Enabling policy environment	IITA ; IFPRI; ILRI; ICRISAT	PACA; EAC; COMESA	
	Communication	IITA , IFPRI, ILRI, ICRISAT, CIMMYT		

Proposing center in bold. PS=private sector; ARI=advanced research institute; NARS=national agricultural research systems; PMIL= peanut and mycotoxin innovation lab; PACA=partnership for aflatoxin control in Africa; STDF=Standards and trade development facility; other acronyms are standard



General discussion

Participants next discussed some of the key areas for development in the next phase of CRP A4NH mycotoxin work.

Diagnostics for use (fit for purpose)

- Key for management as well as research
- Desired test characteristics depend on intended use (level of precision, practicality, cost)
- Opportunity to adapt diagnostics developed by private sector and others outside CG
- Important for CG to have common protocols and diagnostic tools (in order to produce comparable data)
- Diagnostic methods need to be appropriate for recognized regulatory standards and sampling protocols (suitable for large traded shipments or samples from smallholder farms)

Microbial soil populations

- Important to understand effectiveness and externalities of biocontrol; what is the optimal profile of strains to be applied to achieve maximal and durable control across sites and seasons?
- Evaluate impact of different control technologies on microbial populations that are both antagonistic (e.g. toxigenic *Aspergillus* strains) and beneficial (e.g. nutrient cycling) to crop performance and quality
- May identify future biocontrol and control options?
- Tools: proteomics; RNA; biochemical; abiotic measures, perhaps metagenomics
- CGIAR has a strategic advantage is this basic research

Risk assessment

- Risk assessment requires consumption data as well as prevalence data
- Evidence around human health is key to buy-in from medical community
- Definitive link with human stunting probably requires randomized control trials
- Important to put economic values on impacts and look at multiple impacts

Theory of change and impact pathways

- Scaling up aflatoxin research in phase 2 of CRP A4NH requires a strong impact pathway
- This should link CGIAR research to impacts for millions of people
- Ongoing work by CRP 4 (Nancy Johnson) is developing a theory of change
- Need a joined up and programmatic approach across the CGIAR centers
- Test and develop implementation pathways suited to private or public sector

Way forward

- Commission some papers over targeted areas of key research
- Contribute to theory of change being currently developed
- Build communication around mycotoxins in CRP A4NH
- Form working groups around key areas
- Evaluate the efficiency of implementation pathways and their impacts



Schedule

Participants next listed some of the important upcoming aflatoxin events:

2013

5th November: Launch of 2020 aflatoxin briefs by IFPRI in Washington DC USA

14th November: Launch of 2012 aflatoxin briefs by ILRI in Nairobi, Kenya

5-6th November: Partnership for Aflatoxin Control in Africa (PACA) will hold a three-day stakeholder consultation in Accra, Ghana for West African countries affiliated with ECOWAS

18th November – Evidence informed food safety policy, FAO, Rome

25th November: Public Foundation of Health India- ILRI meeting on zoonoses, food safety and ecohealth in Delhi, India

9th-10th December: second annual GFSP stakeholder consultation in Singapore. If ready, report on Pathways to Mycotoxin Control

10th December: ASARECA General Assembly side meeting on the ASARECA CRPs collaboration in Bujumbura, Burundi

2014

18th-20th January – Global Food Safety and Nutrition Summit India

To update

Participants also listed important initiatives dealing with aflatoxins with which partnerships are already in place or under development

Partnership for Aflatoxin Control in Africa

Peanut and Mycotoxin Innovation Laboratory

Global Food Security Initiative



Action points

Impact pathways and theory of change

We hope to scale up food safety work in the next phase of CRP funding and for this it is important to build a strong case for potential impact. The impact pathway and theory of change for impact from mycotoxins research will be developed and published in a book and/or papers. Nancy will follow-up with identified contributors by end next week to discuss the way forward.

Working groups

Three working groups will help plan and coordinate research across CG centers. John will circulate the detailed TORSs to group members by the end of next week. Members include (one listed per centre):

- Evidence for risk and risk reduction (DG, FW, VH, tbd)
- Diagnostics for use (JH, FB, HS, GM, [JLeroy tbc])
- Population biology to better understand control options (HS, JH, FB, GM)

Coordination and planning

In order for the A4NH group to better plan and coordinate across centres and within groups it was agreed:

- Communication would be facilitated by DG, RB, FW
- Each centre has one Mycotoxin Center Focal Point (DG; FW; GM, RB, VH) responsible for communicating with relevant people in their Center
- Progress updates would be circulated each month: Amanda to set up group email covering both Mycotoxin Focal Points and Working Group Members
- Data sharing would be set up through Team space and Drop Box: Amanda to help with communication

Next meeting

The next meeting of the Mycotoxin Focal Point Group is provisionally planned for 20-21 March Washington DC. A4NH will support participation by one person per center.

Mycotoxin Center Focal Point:

These were confirmed in the meeting as Delia, Farid, George, Ranajit, Vivian for the five centers and Jagger for the BecA facility.



Terms of reference for working groups

At the CGIAR aflatoxin research coordination meeting in Naivasha, October 9-11, we agreed to establish 3 working groups to help plan and coordinate research across the CGIAR Centers and CRPs more efficiently and effectively.

The three working groups are:

1. Evidence of risks of aflatoxins and risk reduction of different interventions. This group would look at key risk management and communication issues including incentives, agency, policy and regulation.
2. Diagnostics – looking at what diagnostics are needed along the impact pathways and theories of changing (being developed in parallel) and how to improve sensitivity, specificity, practicality, standardization and sampling to meet these needs.
3. Population Biology – This group will look at the population dynamics of fungal populations with different interventions, particularly those related to bio-control.

Working group members:

Evidence – Delia Grace, Vivian Hoffmann, Farid Waliyar, other tbd

Diagnostics – Fen Beed, Jagger Harvey, Hari Sudini, George Mahuku, Jef Leroy (tbc)

Population Biology - Fen Beed, Jagger Harvey, Hari Sudini, George Mahuku, Benoit, Moses Osiru

Terms of reference:

1. Assemble existing information in the research area and link to the group developing impact pathways and theories of change for aflatoxin risk mitigation.
2. Compile current research being undertaken in this research area and discuss and implement as possible more coordinated research.
3. Plan for a future research agenda in this area from 2015-2018 that can be included in the 2nd phase proposals for CRPs (A4NH, Maize and Grain Legumes).

Time frame:

Plans for future research need be completed by June 2014. Assembling existing information, compiling and coordinating current research and a preliminary plan for future research will be discussed at the next CGIAR aflatoxin coordination meeting, March 20-21 2014 at IFPRI in Washington DC.



Meeting participants

BecA

Jagger Harvey
Benoit Gnonlonfin

CIMMYT

George Mahuku

ICRISAT

Anitha S
Farid Waliyar
Harikshan Sudini
Moses Osiru
Samuel Njoroge

IITA

Fen Beed

ILRI

Delia Grace
Johanna Lindahl

IFPRI

Charlotte Block
John McDermott
Nancy Johnson
Nouhoum Traoré

Logistics

Rosekellen Njiru