

Detection and management of mycotoxins for food quality in Benin

**Benoit Gnonlonfin (INRAB; MSc.
Applied microbiology, Post harvest
technologist)**

Background

- **Food security and food safety**
- **Factors that affects foods quality**
 - Presence of microorganisms (bacteria, yeast, fungi, viruses)
 - Toxins production
 - Pesticides residues (control)



Foods contamination by microorganisms

- **Microorganisms causes diseases**
 - **Bacteria: Outbreak (abdominal pain, diarrhoea, vomiting, etc.); production of toxins**
 - **Viruses: Outbreak and led to death**
 - **Fungi: production of mycotoxins (highly carcinogens)**
- **Control: used of pesticides and preservatives**

- Application at high doses
- Lack of training/information (mainly farmers)
- Used of non recommendable practices
- Non applicability of strict legislation/regulation and control
- All led to pesticides residues in contaminated foods (poor quality)

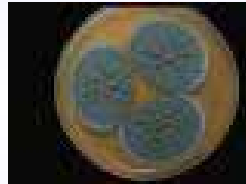
- Importance to identify the pathogens
- Still, need for further investigations:
Mycotoxins
- Mycotoxins (secondary metabolites produced by fungi species)

Mycotoxins

- Harmful to human and animal
- Impact on international trade



Fusarium verticillioides



Penicillium spp



Aspergillus flavus

Impact of mycotoxins on health: chronic/sub chronic, acute effect

■ Human

- immunosuppressive
- Hepatocarcinogen
- Early growth retardation
- Suspected for increasing HIV epidemic and malaria incidence

■ Animal

- Reduction/suppression of cell-mediated immune response
- Suppression of lymphoblastogenesis
- Leucoencephalomalacia in horse
- Pulmonary oedema (pork)

- **Acute toxicity**

- Edema
- Bile proliferation
- Hemorrhagic necrosis of liver

- **Led to death: 25%** (Williams et al., 2004)

Impact on international trade

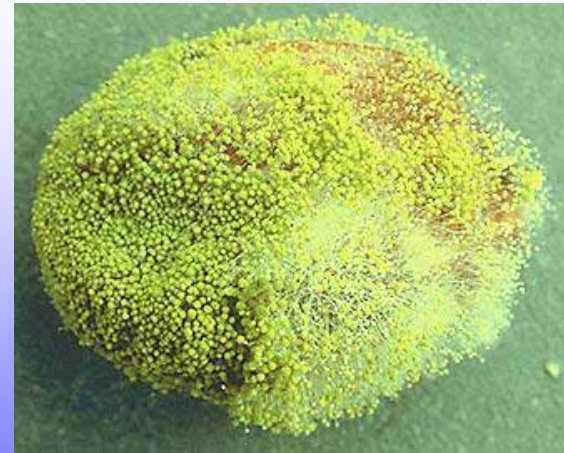
- Mycotoxins contamination have impact on the **quality**
 - Reduction (quality): **64%** (WHO, 2000)
- Best quality exported
- Poorer quality consumed domestically

Commodities susceptible to mycotoxins contamination in Benin?

- Groundnut
- Maize
- Cashew
- Sorghum
- Yam chips



Maize



Groundnut

Mycotoxins research in Benin

Aflatoxins determination?

- Sample preparation
- Extraction
- Screening (TLC) (Depart. of Biological Sciences/UB)
- Determination (HPLC) (Depart. of Biological Sciences/UB)
- Quantitation
- Recovery (standards spiked): 80%



Fumonisin B₁ determination?

- Sample preparation
- Extraction
- Determination (HPLC) (University of Botswana)
- Quantitation
- Recovery (standards spiked): 100%

■ Detection and prevalence

– Maize

44% samples are aflatoxins positive (mean **116 ppb**)

More prevalence in SGS and SS (Hell et al., 2000)

100% samples are fumonisins positive (mean **8.3 ppm**)

Higher prevalence in FMS and SGS (Fandohan et al., 2005)



- **Cowpea**

all aflatoxins and fumonisins positive (30 samples)
mean of **5.92 ppb** (Fandohan et al., unpublished data)

- **Groundnut**

3-20ppb 2.9%, **>20ppb** (FDA) 1.7% (Cardwell et al., 2001)

- **Yam chips**

> 15 ppb (CODEX) 23% (Mestres et al., 2004)

– Cassava chips

200 samples, 100% (**no aflatoxins and fumonisins**) (Gnonlonfin et al., paper in preparation)

Mycotoxins control?

- ***Post harvest operations***
 - ***Handling and processing***
 - Sorting, winnowing, washing, crushing combined with dehulling*** (mycotoxins reduction about 80%) (Fandohan et al., 2005)





Ocimum gratissimum



Ocimum basilicum



Cymbopogon citratus

Effect of essential oil (4.8 $\mu\text{L/g}$) (Fandohan et al., 2004)

Cymbopogon citratus

Ocimum basilicum

Ocimum gratissimum

■ **Biological control (aflatoxins)**

- Ability to produce aflatoxin in *A. flavus* strains varies
- Some strains produce a lot (toxigenic), and others little aflatoxin (atoxigenic)
- Diversity studies in Benin identified strain BN40 as toxigenic and BN30 as atoxigenic (IITA, 2003)

■ **Management technologies**

– Good agricultural practices

– Mycotoxin management strategies



Quality assurance

Awareness campaign(Rotary International)

- Training (Scientists)
- Information (maize farmers, traders, poultry farmers, animal feed producers, consumers)
- Stakeholder meeting



Collaboration

- **NARS (National Agricultural Research System)**
 - **INRAB (National Institute of Agricultural Research in Benin)**
 - **University (Faculty of Sciences and Agronomic, FSA; Pharmacognosy laboratory/Faculty of Arts Sciences and Techniques)**
 - **NGO's (Non Governmental Organization)**
 - **BCSTR (Benin Centre for Scientific and Technical Research)**

Constraints?

- **Unavailability**

- **Financial resources**

Research funds on project (end project → end financial support)

Government not able to provide funds for carrying research

- **Equipments**

Sustainability (long time/period)

- Building capacity (Training facility)
- Accredited laboratories

Perspectives?

- **Training (personnel, farmers)**
- **Mycotoxins in other food commodities**
 - Cashew
 - Shea
 - Cowpea?
 - Cassava?
 - Fruits and vegetables
- **Studies needed on other mycotoxins (ochratoxin, cyclopianoizid acid)**
- **Studies needed food hygiene: spoilage by enterotoxigenic bacteria (*Escherichia coli*, *Bacillus cereus*, *Salmonella spp*)**
- **Implement laboratory/reinforce the existing for analyzing pesticide residues**

Thank you