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UMR QualiSud

Joint Research Unit "Integrated approach for producing quality food"

Post-harvest drying, storage and handling/value chain analysis

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CIRAD expertise on mycotoxins & food safety

Previous projects on mycotoxin control in food chains

	Food/Mycotoxins	Financing/Period	Geographical area
CIRAD coordination	Groundnut/AF Corn & wheat /AF, FUM, ZEA… Brazil nut/AF	FP6 INCO-DEV (2001-06) FP5 INCO-DEV Mycotox (2003-06) STDF (WTO) Safenut (2006-08)	Sahel Africa (Senegal, Mali) Latin America Brazil, Amazon region
Other projects	Cocoa/OTA Coffee/OTA	Caobisco/ECA/FCC (2000-04) ICO/CFC/FAO (2001-05)	Ivory Coast Ivory Coast, Kenya, Uganda, Asian & Latin American partners

Current projects on food safety, including mycotoxin aspects

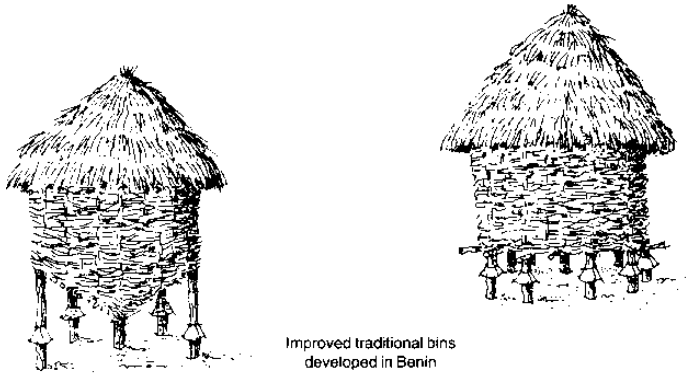
	Project	Financing/Period	Geographical area
CIRAD coordination	AFTER, African traditional foods 3CIvoire, Food safety	FP7 (2010-13) EuropeAid (2011-13)	Senegal, Ghana, Benin, IC, Egypt, Cameroon, Madagascar, South Africa
Other projects	EDES, Food safety	9th EDF (2010-14)	ACP

Post-harvest practices for aflatoxin control (1/4)

Critical factors	Proper drying as quickly as possible
Low moisture content and water activity (a_w)	**Appropriate temperature & time** Products should be dried to a safe moisture content (a_w <0.7) Grains: MC < 14% Groundnuts: MC < 8% Cotton seeds: MC < 10% Process adjustments where operating limits are violated
Avoid cross-contamination	Cleaning of dryers

Post-harvest practices for aflatoxin control (2/4)

Critical factors	Proper storage
Low moisture content and a_w to be kept after drying (avoid re-wetting) Temperature	**Control of humidity, temperature, ventilation** Appropriate storage facility & packaging Process adjustments where operating limits are violated
Avoid immature, mouldy & damaged products	**Manual or mechanical sorting/segregation**, based on product density, colour, damages, greenish-yellow fluorescence under UV light… Use of antifungal treatments
Avoid pest physical damages	Appropriate packaging General hygiene Pest control
Avoid cross-contamination	Cleaning of stores & packaging



Improved traditional bins developed in Benin

Intact

Mouldy

Insect attack

Post-harvest practices for aflatoxin control (3/4)

Critical factors	Proper transportation
Low moisture content and a_w to be kept	Control of humidity, temperature, ventilation Appropriate packaging
Avoid mouldy & damaged products	Appropriate food state
Avoid pest physical damages	Appropriate packaging General hygiene Pest control
Avoid cross-contamination	Cleaning of containers… & packaging Containers should be clean, dry and free of insects & fungal growth

Post-harvest practices for aflatoxin control (4/4)

Processing

Physical treatments	**Heating** (autoclaving, groundnut roasting; maize extrusion…) Decreases AF levels, but AF not completely destroyed **Controlled atmosphere:** AF production greatly restricted if O2<1% and CO2 increased **Milling:** Separation of grains into fractions and elimination of the toxic portions (bran and germ in dry milling) **Pulsed light** (UVC-near IR), during 300 µs, up to 5 times/s
Chemical treatments	**Ozonation,** but nutritional value affected **Application in feedstuff industry:** **AF adsorption/binders:** calcium alumino-silicates **AF decomposition** (95-98%): Ammoniation
Biological treatments	**Microbial detoxification** **Fermentation, silage**

Existing guides of good practices

Diagnostic: gaps and needs for AF control in Africa (1/2)

Understand fungal growth & AF production along the production chain

Identification of critical points & factors

Develop & validate preventive and controlling measures

Sampling and analytical methods for AF surveillance & monitoring

Critical Point: preparation of representative samples

Appropriation & adoption of the AF management system by the private sector

Promoting good practice implementation

- **Existing knowledge and preventive measures already tested and validated**
- **Nevertheless, needs to confirm critical points & factors, to adapt to the local context, test and validate technical procedures/equipment**

NB: Biological control: check that other mycotoxins are not produced

Diagnostic: gaps and needs for AF control in Africa (2/2)

Applied & participative research actions focusing on:

- Preventive measures instead of curative by limiting the risk at each stage from the field to consumption
- Sustainable measures : cost-effective & environmentally friendly (use of alternatives to chemicals, renewable energy…)
- Constraints and strategies for the adoption of an AF management system
  Evaluation of the cost/benefit of preventive measures, promoting incentives…

No research without impact on society

Contribution to innovation dissemination and education for AF awareness

- **Training in good practices for the private sector**
- **Strengthening laboratory and surveillance capacities**
- **Promoting information and communication (specialized media...) to encourage political support**

To summarize: proposed strategy for PACA

- **Integrated approach, from farm to fork**

  Limit the risks of AF contamination along the food chain as they are at each step

- **Concerted effort of all actors along the food production chain**

  Private sector (farmers, industries…), R&D institutes, public and regulatory authorities, NGO, Civil Society Organizations…

  ☞ Need for adequate social organization & coordination between chain actors

- **Multidisciplinary approach**

  By integrating technical and socio-economical aspects to develop a sustainable AF management system

- **In coordination with other projects/activities, as platform for complementary actions**
  - FP7 Mycored project (2009-13) : Novel integrated strategies for worldwide mycotoxin reduction in food and feed chains

    Mycored Africa 2011, 4-6 April, South Africa
  - EDES project
  - AFTER project
  - STDF program…

Schematic representation of proposed strategy