RESEARCH PROJECT

# Post-harvest management technologies for reducing aflatoxins contamination in maize grain and exposure to humans

## Project duration

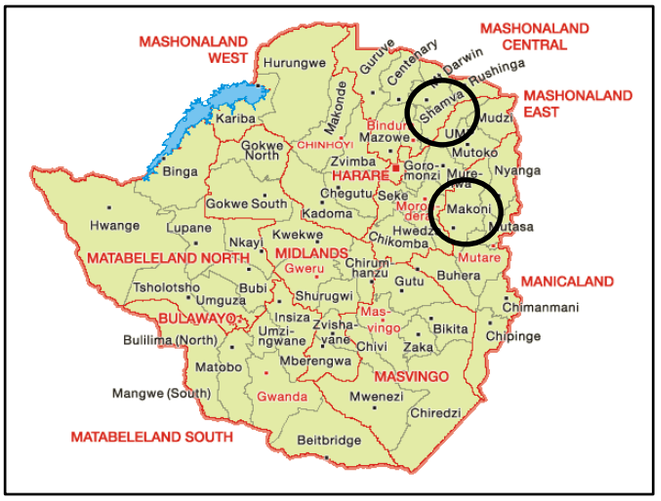
01/10/2014-30/03/2017 (30 Months)

## Intervention Zone

Shamva and Makoni districts, Zimbabwe

## Project objectives

The broad objective of the research study is to investigate efficacy of hermetic storage technology in reduction of mycotoxin contamination in maize grain and hence, reduction in exposure of humans to these toxins, in Makoni and Shamva districts, Zimbabwe.




## BACKGROUND AND CONTEXT

Maize is the main staple food consumed in Zimbabwe and has been reported by Gamanya et al. (2001) to be contaminated by mycotoxins. Several species of fungi infect agricultural crops both in the field and during storage. These include *Apergillus*, *Fusarium*, *Penicillium*, *Alternaria*, *Cladosporium* and *Nigrospora* species (Hocking, 1991) and have been mainly found associated with cereals, nuts and spices. In addition to reduction of yield to these crops some these moulds produce mycotoxins which are poisonous substances.

The most widely studied and dangerous mycotoxins are aflatoxins. Aflatoxins are carcinogenic and teratogenic, metabolites produced by *Apergillus flavus* and *Aspergillus parasiticus* and can be found in wide range of food and feed. Mycotoxins and their metabolites are excreted from the body by biological fluid.

Aflatoxin $M_1$ ($AFM_1$) is the predominant metabolite of Aflatoxin $B_1$ ($AFB_1$) in milk from lactating humans and animals that consume contaminated food or feed. Aflatoxin $M_1$ can serve as a biomarker to reveal the extent and level of human aflatoxin exposure in a way that food analysis cannot.

Breast milk contains all the nutrients needed by infants in the first 6 months of life. For this reason when human breast milk is contaminated with aflatoxins, this presents a potentially serious health hazard to the infant.

## SUMMARY

Six administrative cluster areas will be purposively selected from each district. These cluster areas will be spread across three farming sectors in the district. Predominantly maize growing cluster areas that are accessible throughout the year will be selected. Within each cluster area, two enumeration areas (EAs) will be randomly selected. Overall, 12 EAs will be selected from each district. A household listing exercise will be conducted in each Enumeration Area to identify maize farming households with children 0-24 months and with pregnant women. Once the list of eligible households is obtained, households will be selected randomly to participate in the study. This study, though exploratory, will have a temporal as well as cross-sectional dimension.

As such, 480 households will be selected randomly selected from the two districts. Only one under-five child per household will be randomly recruited. Breastfeeding mothers of recruited infants will be asked to join. At least 60 of the selected households should have pregnant women. Households will be randomly allocated into one of the three treatment groups (one group will receive metal silos, second group to receive super bags and the third group will be the control group). Informed consent of the participating households and children will be obtained from household heads and mothers respectively.

A randomized controlled trial (RCT) design will be set up to test whether hermetic storage technologies are effective in reducing aflatoxin contamination in stored maize. It is hypothesized that the hermetic storage interventions would decrease aflatoxin contamination. Using this design it is feasible to determine the presence of a relationship between use of hermetic technologies for maize storage and reduced aflatoxin contamination in maize and exposure to humans especially women and children under five. Monitoring contamination of household grain stocks and exposure of household members to contaminated grain is sufficient to validate the effects of this intervention. It is hoped that this RCT will find evidence of reduction in aflatoxin contamination for maize stored by the majority of farmers using hermetic technology.

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## PRIMARY OBJECTIVE

- To reduce human exposure to aflatoxins through adoption of hermetic storage technology for maize grain.

## SPECIFIC OBJECTIVES

- To assess knowledge, attitudes and practices with regard to good pre- and post- harvest management practices that minimizes mycotoxin contamination in maize;
- To assess the reduction of aflatoxins in stored grain from use of different postharvest storage practices (metal silos, hermetic bags and storage practices);
- To assess the reduction of aflatoxins exposure to humans including infants;
- To assess the levels of aflatoxins in legumes (groundnuts, bambara, beans, and cowpeas) produced by the communities in Shamva and Makoni districts;
- To identify and assess different models for delivery of post-harvest management technologies to smallholder grain producers; and
- To identify dissemination approaches and disseminate information on improved post-harvest management locally and nationally.

## EXPECTED OUTPUTS

At least six research articles will be published in referred journal from the research project as follows:

- Efficacy of hermetic technologies to reduce aflatoxin levels in stored grain
- Infants exposure to aflatoxin $M_1$ from breast milk from mothers in the intervention and control groups in Shamva and Makoni districts
- Association between anthropometric data and levels of aflatoxins in children under five in control and intervention groups
- Knowledge, attitudes and perceptions of farmers and institutional gaps in managing aflatoxin risks in maize: Baseline survey
- Household behaviors and perceptions in handling risks of aflatoxin contamination
- Two masters graduates in Food Science and Technology

## Implementing agency

- Action Contre la Faim – France
- IRC

## Sponsor and funder:

- Canada's International Development Research Centre (IDRC)
- Australian International Food Security Centre (AIFSRC), represented by Australian Centre for International Agriculture Research (ACIAR)

## Scientific partners

- University of Zimbabwe (UZ)
- International Rescue Committee (IRC)

## For more details…

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