Research Proposal: Interventions to Decrease Mycotoxin Risks

Description

Producer and consumer interventions to decrease peanut mycotoxin risk in Ghana (Producer and consumer mycotoxin interventions in Ghana)

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Geographical Locations

Northern Ghana

Project Duration

January 1, 2014 – December 31, 2016

Executive Summary

Groundnuts are a cornerstone of the Ghanaian agriculture and food industry. The provide income to many farmers and protein for consumers throughout the country. Aflatoxin (a specific mycotoxin) exposure is perhaps the most daunting challenge facing agriculture in Ghana and peanuts are particularly susceptible. Scientists have developed and continue to develop techniques producers can use to prevent aflatoxin infection in peanuts. Adoption of such practices, however, is not as widespread as hoped in Ghana and throughout Africa. One of the main reasons for the absence of adoption of techniques that mitigate aflatoxin risk is the lack of knowledge about aflatoxins and the risks they impose by both producers and consumers. Given this lack of information joint to the lack of regulation and transparency, producers do not have adequate incentives to employ aflatoxin prevention measures.

This research will investigate the relative and combined impact of producer-side and consumer-side aflatoxin mitigation interventions for peanuts. On the consumer side, interventions will inform consumers about the risk of aflatoxin, its prevalence in various peanut products, and importantly, the measures that producers and processors can use to ensure a safe supply of peanuts. Ideally, an informed consumer will be able to identify and seek out peanuts and peanut products with a lower risk of aflatoxin so that producers taking safety measures will be rewarded with increased demand. Producer-side interventions will include similar information about the risks and preventative measures. The interventions will include more detailed information on how these preventative measures can be implemented as well as assistance in implementation. We will work with local experts to identify the preventative measures with the best potential to long-term and affordable solutions. Consumer-side and producer-side interventions both have the potential to reduce aflatoxin risk on their own. A combined intervention, however, stands to have a greater impact than the sum of the independent impact s. This study will rigorously test the relative impact and cost-

effectiveness of producer-side, and combined interventions using a randomized controlled trial (RCT).

The RCT will establish three sets of villages. Because information travels within a village, a village-level randomization (as opposed to a household-level randomization) is appropriate. The first set of villages will receive the producer-side intervention only. The second set of villages will receive both interventions and the third set will serve as a control. In treatment villages we will randomly select a group of producers and/or consumers to receive the treatment and be part of the study. Within each treatment village we will randomly select a group of producers and/or consumers to be part of the study but not directly receive the intervention. We will also randomly select producers and/or consumers in the control group to participate in the study. In Ghana, women constitute over 48% of the agricultural labor force. Furthermore, women are the main purchasers of groundnuts, who then used them to make paste and extract oil. Hence, when designing the questionnaires and intervention we will take into account gender differences. We will build in modules on gender, individual assets and joint asset ownership at baseline. In this way we will attempt to capture the gender dynamic around reasons why/why not individuals/household adopt control measures.

The interventions have the potential to impact a variety of outcomes on which we will collect pre- and post-intervention data. These include aflatoxin levels in peanuts, prices of peanuts and knowledge of aflatoxins, aflatoxin risk, and preventative measures. By comparing outcomes of treated producers and consumers in treatment villages to those of their counterparts in control villages we can estimate the direct impact of the individual interventions and the combined interventions. Finally, we will also be able to compare their effects to see which intervention is the most cost-effective.

Project Description

Goal

To understand how producer-side and consumer-side interventions can be used independently or together to reduce mycotoxin risk in the peanut value chain.

Relevance and Justification

Groundnuts are a cornerstone of the Ghanaian agriculture and food industry. They provide income to farmers and protein for consumers throughout the country (Florkowski and Kolavalli, 2012). According to Florkowski and Kolavalli

(2013) 495,000 metric tons of groundnuts were produce in 2009, of which most came from the Northern and Upper East regions. Furthermore, most of the Ghanaian population, (around 80 percent), consume peanuts or peanut products at least once a week (Jolly et al. 2008). Aflatoxin (a specific mycotoxin) exposure is perhaps the most daunting challenge facing agriculture in Ghana (Ghana Business News, 2013), and peanuts are particularly susceptible. Scientists have developed and continue to develop techniques producers can use to prevent aflatoxin infection in peanuts (Dorner,2008). Adoption of such practices, however, is not widespread in Ghana and throughout Africa.

During the post-harvest stage, there are many interventions that can be used to contain the spread of aflatoxins: proper drying and sorting of peanuts before storage, aeration, keeping a low temperature and controlling the levels of humidity in storage by avoiding storage containers that promote humidity, such as plastics bags (Strosnider et al. 2006, Turner et al. 2005). In addition pest control can influence the level of aflatoxin risk in storage since pests can produce humidity and spread fungal spores (Hell, Cardwell, and Poehling 2003; Lamboni and Hell 2009).

Two additional related constraints are at the root of the high level of aflatoxin risk in Northern Ghana: (1) Producers, consumers, and other agents in the peanut value chain know very little about aflatoxins and the risks they impose (Jolly, et al., 2009; Wu and Khlangwiset, 2010), and (2) Because of the lack of information, regulation, and transparency, producers do not have adequate incentives to employ aflatoxin prevention measures (Hoffmann, et al.; Wu and Khlangwiset, 2010). Peanut growers that are not informed about the risks of aflatoxins and how to prevent them will not do so (Tiongco et al. 2011). However, without regulation even informed growers may not take appropriate measures if they are not rewarded for doing so by the market. If consumers do not place a premium on peanuts produced by growers taking aflatoxin-mitigating measures, producers will not necessarily adopt these costly practices. Because consumers cannot always readily inspect peanuts and especially processed peanut products for aflatoxin risk, knowledge of producer practices and transparency in the value chain is critical.

Several studies have analyzed the impact of improved storage methods aimed at reducing aflatoxin levels in storage units (Hell and Mutegi 2011, Udoh, Cardwell, and Ikotun 2000). Yet none of these studies have been able to tackle successfully the endogeneity and selection issues involved in the estimation of the causal impact of improved storage techniques on aflatoxin

levels. Our study will use a randomized control trial (RCT) to deal with these identification issues. The few studies that have been able to deal with identification issues (Turner et al. 2005) have concentrated solely in producer side interventions. Our study contributes to the literature by proposing a project that will examine the effectiveness of an intervention aimed at peanut producers with and without a complimentary intervention aimed at increasing consumer awareness of the dangers of aflatoxin and the precautions producers can take to reduce the risks.

Research Plan

Objective(s)

This research will investigate the impact of a production-side aflatoxin-mitigating intervention for peanuts, with and without a complementary consumer-side intervention. A consumer-side intervention will inform consumers about the risk of aflatoxin, its prevalence in various peanut products, and the measures that producers and processors can use to ensure a safe supply of peanuts. Ideally, an informed consumer will be able to identify and seek out peanuts and peanut products with a lower risk of aflatoxin so that producers taking safety measures will be rewarded with increased demand and higher prices.

Producer-side interventions will include similar information about risks and preventative measures. These interventions will include more detailed information on how preventative measures can be implemented as well as assistance in implementation. Following Turner et al. (2005) a postharvest intervention package to reduce aflatoxin in groundnuts, will be chosen. The package could potentially consist of one or more of the following components:

- Information acute and chronic health impacts of aflatoxin
- Information about the factors that cause and exacerbate aflatoxin spread
- Education for groundnut farmers on hand-sorting nuts, natural-fiber mats for drying the nuts
- Education on proper sun drying, natural-fiber bags for storage, wooden pallets on which to store bags, and insecticides applied on the floor of the storage facility under the pallets.
- Information on the cost of techniques to mitigate for aflatoxin growth, and their potential economic benefits
- A tarpaulin to use at harvest, drying and threshing to reduce the risk of contamination from exposure to the soil
- Natural fiber sacks or metal silos to avoid build-up of moisture in storage
- Wooden pallets on which to place bags of peanuts in storage

We will work with local experts to identify the preventative measures with the best potential to be long-term and affordable solutions.

Consumer-side and producer-side interventions both have the potential to reduce aflatoxin risk on their own. A combined intervention, however, stands to have a greater impact than the sum of the independent impacts. Informed consumers will be able to reward producers who implement aflatoxin- reducing measures, and informed and equipped producers will be able to serve the needs of informed consumers. This study will rigorously test the relative impact and cost-effectiveness of producer-side, consumer-side, and combined interventions using a randomized controlled trial (RCT).

The RCT will establish three sets of villages. Because information travels within a village, a village-level randomization (as opposed to a household-level randomization) is appropriate. The first set of villages will receive the producer-side intervention only. The second set of villages will receive both interventions and the third set will serve as a control. In treatment villages we will randomly select a group of producers and/or consumers to receive the treatment and be part of the study. Within each treatment village we will randomly select a group of producers and/or consumers to be part of the study but not directly receive the intervention. We will also randomly select producers and/or consumers in the control group to participate in the study.

The independent and combined interventions have the potential to impact a variety of outcomes on which we will collect pre- and post-intervention data. These include aflatoxin levels in peanuts kept in storage from various producers; sales and purchase quantities and prices of various peanut products; knowledge of aflatoxin, aflatoxin risk, and preventative measures among producers and consumers. By comparing outcomes of treated producers and consumers in treatment villages to those of their counterparts in control villages we can estimate the direct impact of the individual interventions and the combined interventions. We can also compare their effects to see which intervention is the most cost- effective. Furthermore, we can compare outcomes for untreated producers and consumers in treatment villages to their counterparts in control villages to estimate spillover effects. For interventions such as these, knowing whether or not spillovers occur is essential to understand their potential to be spread and be sustainable (Kremer and Miguel, 2007).

Role of Each Scientist/Partner

Nicholas Magnan and Gissele Gajate-Garrido

Will oversee the project and provide intellectual leadership. They will design the randomized controlled experiment and lead sample selection and survey creation. Nicholas Magnan will serve as the dissertation committee chair for Daniel Kanyam, the Ph.D. student working on this project. Drs. Magnan and Gajate-Garrido will co-author several academic papers with other team members for top economics journals using the data collected from this study.

Dr. Clement Ahiadeke

Will recruit enumerators, organize data collection logistics, co-author papers, and present findings within Ghana. He will assist in survey design and sample selection, drawing on his extensive experience working in Ghana.

Daniel Akwasi Kanyam

Is a UGA Ph.D. candidate from Northern Ghana. Mr. Kanyam will develop his own research questions that fall under the broader aims of this project. He will assist in experimental design, survey creation, sample selection, statistical analysis, and article writing. He will also oversee field operations in Ghana. All of these activities are fundamental to his training as an agricultural economist. After participating in this he will be able to develop testable research hypotheses, lead his own field surveys, analyze household data, and write scientific articles of high quality. He will be prepared for a career in agricultural economics and international development in Ghana, the United States, or elsewhere.

Annual Work Plan, Milestones and Timeline

2014	Activities	Milestones
Jan-March 2014	Literature review Organize scoping visit	Literature review complete
April 2014	Scoping visit to Ghana: Select sample villages, conduct farmer and consumer focus groups assess possible interventions Note: PI and co-PI will make a short visit (~10 days) and GSA will make a longer visit	Sample area identified
May-June 2014	Prepare report from scoping visit Begin to design intervention	Scoping visit report completed

July – Nov 2014	*Survey* Draft baseline survey Program survey for computer aided personal interview (CAPI) Enumerators recruited in Ghana by Dr. Ahiadeke *Intervention* Continue to design intervention, procure/produce intervention materials Select treatment and control villages Complete IRB process and training	Baseline survey draft completed and programmed using CAPI software Intervention protocol completed IRB approval granted
Dec 2014	Baseline survey pre-test and launch	Baseline survey data collected
2015	**Activities**	**Milestones**
Jan 2015	Baseline peanut sampling and testing	Baseline aflatoxin data collected
Feb 2015	Production and consumption interventions	
Mar – Jun 2015	Cleaning and preliminary analysis of baseline data Write report using baseline data	Abstract and paper on baseline data submitted for Agricultural and Applied Economics conference
Jul – Nov 2015	Draft end line survey Program survey for computer aided personal interview (CAPI) Enumerators (re-)recruited in Ghana by Dr. Ahiadeke	End line survey draft completed and programmed using CAPI software
Dec 2015	End line survey	End line survey data collected
2016	**Activities**	**Milestones**
Jan 2016	End line aflatoxin sampling and testing	End line aflatoxin data collected
Feb – June 2016	Clean end line data and merge with baseline data Analyze data, write papers	Abstract and paper on final data submitted for Agricultural and Applied Economics conference
July – Sep 2016	Prepare papers for online publication as IFPRI discussion papers Student prepares dissertation	IFPRI Discussion Paper published online
Oct – Dec 2016	Finalize papers for journal submission Prepare policy reports for dissemination in Ghana Prepare final reports for PMIL	Papers submitted to academic journals Policy brief released in Ghana Ph.D. student graduates.

Agriculture is still to this day one of the main activities in Ghana accounting for around 38% of GDP and affecting the livelihood of rural dwellers, which add up to 51% of the country's population.[1] The role of women in Ghanaian agriculture is essential. According to the Ghana Statistical Services (GSS) women constitute over 48% of the agricultural labor force in the country (based on 2000 Population Census) with an important presence in all regions. In Ghana the main system of farming is traditional with little to no mechanization making agricultural labor critical for its success. Hence it is of outmost importance to understand the constraints to female participation and productivity in agricultural activities.

Women are also the primary purchasers of food, so their knowledge of food risks affects their entire family's health. An informed consumer base stands to increase demand for safe peanuts and peanut products, and decrease demand for unsafe ones. Through the market mechanism, informing women of the health risk posed by aflatoxin and the measures producers can take to mitigate these risks should incite producers to use the preventative measures at their disposal. Furthermore, many women generate income by producing peanut products such as vegetable oil (Tsigbey, Brandenburg, and Clottey 2004; Florkowski and Kolavalli, 2012) or though petty commerce that includes selling peanut products (Coallo-Concha, Gaiser, and Ewet 2012). Producers of such intermediate goods could also shift their demand towards safer raw peanuts if they are informed about the risks, and know that their customers are informed.

This study includes surveys aimed at both producers and consumers, as well as interventions aimed at both producers and consumers. We will not target the "head of household" for these interventions, but the person in the household most responsible for production and consumption decisions. In many cases, especially on the consumption side, we anticipate that this will be the female head of household. Indeed according to Florkowski and Kolavalli (2013) women are the main purchasers of groundnuts, who then used them to make paste and extract oil. Hence, when designing the questionnaires and intervention we will take into account gender differences. We will build in modules on gender, individual assets and joint asset ownership at baseline. In this way we will attempt to capture the gender dynamic around

[1] The little Data Book of Africa 2008/2009

reasons why/why not individuals/household adopt control measures. This strategy will also allow us to learn about differences in knowledge and attitudes towards aflatoxin. Accordingly, we will aim to assemble enumeration teams that include both men and women. Gender balance in our enumeration team will facilitate interviews with females, as well as providing field experience to Ghanaian students of both genders.

We will consider gender throughout our analysis. It is possible that the gender of the recipient of information about aflatoxin and, on the producer side, aflatoxin-mitigating materials may matter in terms of how a household responds to the intervention. We will also examine the degree to which spouses share information about aflatoxin, which has implications for how a household uses the information and also for how information disseminates from household to household (Magnan et al. 2013).

Environmental Considerations

We do not anticipate any environmental risks as part of the proposed study. This project will focus on post-harvest aflatoxin prevention practices that will mainly entail behavioral changes (improved sorting and drying) as well as the potential distribution of non-hazardous storage materials (tarpaulin, natural fiber sacks and wooden pallets). We will not introduce any pesticides to study participants. Nor will this project introduce any new germplasm, genetically modified or otherwise.

Outcomes and Impacts

The study's main primary outcome variables will be

1. Aflatoxin contamination levels in peanuts (quantitative)
2. Quantity of peanuts purchased and price paid by consumers (quantitative)
3. Quantity of peanuts sold and price received by producers (quantitative)
4. The effectiveness of implementation of the different treatments in terms of time, effort and resources, at the farm level and in terms of delivery at the institutional level (qualitative)

The study's main secondary outcome variables will be

1. Changes in knowledge, practices
2. Quality and quantity of peanut production and consumption

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