Research Proposal: Aflatoxin financial and health risks along the peanut marketing chain in Ghana

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Geographical Location

Ghana

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Focus

Domain - Aflatoxin Region - Global

Background

Agriculture (including forestry and fishing) is the second major contributor to the GDP. It contributed 35. 4 % of GDP in 2000. The principal crops grown are cocoa, rice, coffee, cassava, groundnut, yams, bananas, Shea-nuts and timber. Of the crops produced in Ghana, corn, yams, groundnut and cassava form the basic ingredients of Ghanaian diet. In 2000, Ghana produced an estimated 1,034,500 metric tons of corn, 7,226,900 metric tons of cassava, 1, 597, 400 metric tons of coco yams, 3,249,000 metric tons of yams, and 190,000 metric tons of groundnuts. In 2005 the estimated hectares in peanut production in Ghana was 470000ha which yielded 440000 metric tons of which 14000 metric tons were exported and 416000 metric tons were used for domestic consumption. Though groundnut is considered a minor crop and makes no significant contribution to exports, it can be considered an essential part of the basic staple. It is included in most of the stews eaten at home and in restaurants. It is consumed roasted, fried, as peanut butter, in sauces and are used in many side dishes. Groundnuts are produced mainly on the relatively dry grass lands areas, but are consumed throughout the country. The main problems with groundnuts are that of storage and marketing. A large proportion of the grains stored are spoilt before the end of the rainy season. Moldiness and aflatoxin contamination are cited as the main causes. The problem of aflatoxin contaminated groundnut is associated to production and post-harvest handling. Adebajo and Idowu found infestation above FAO-WHO permissible level in most snack foods sold in West Africa. The levels of contamination increased with storage time and humidity. The level of aflatoxin was not reduced by boiling, but roasting significantly reduced the level of contamination. Benin is predominantly an agricultural country. About 55% of the economically active population was engaged in the agricultural sector in 2000, which accounted for 38% of GDP that year. Small, independent farmers produce 90% of agricultural output, but only about 17% of the total area is cultivated, much of it in the form of collective farms since 1975. The main food crops are manioc, yams, corn, sorghum, beans, rice, sweet potatoes, pawpaws, guavas, bananas, and coconuts. Production estimates for the main food crops for 1999 were yams, 1,771,000 tons; manioc, 2,377,000 tons; corn, 823,000 tons; sorghum, 154,000 tons; rice, 36,000 tons; dry beans, 94,000 tons; sweet potatoes, 67,000 tons; and millet, 34,000 tons. Benin is self-sufficient in food crops, given favorable weather conditions. In 2005 the area planted was 160,000ha which produced 130,000 metric tons of which 54,000 metric tons were crushed and 55,000metric tons were consumed. The groundnuts consumed are heavily contaminated with aflatoxin. Jolly et al. (2007) found that levels of aflatoxin up to 800 ppb are noted at various stages of the marketing chain.

Technical Review

Aflatoxin in groundnuts is a potential risk hazard to humans wherever groundnuts are consumed. It is even worst in West African countries, especially in Ghana, where large quantities form part of the basic diet. It is the common fear that it will enter the basic food chain of humans and cause severe health problems. Though Nwokolo and Oknonkwo indicated high risks were associated to areas with large cereal and groundnut consumption, there have been very few studies to actually estimate probabilities and risks ratios associated to the occurrence of the disease in groundnut marketed and consumed locally. Carlborg and the FDA have made an assessment of health risks associated with aflatoxin ingestion. Studies on the prevalence of AF in foods grown and consumed in Ghana have been few. The earliest work conducted on AF in groundnut in Ghana was that done by Bearwood who surveyed market groundnut in Accra and reported that 69% of the samples tested were highly contaminated with the toxin. Mintah analyzed 80 market groundnut samples from the Accra area and indicated that several of the samples especially those emanating from the more humid Volta region, had AF levels that exceeded the 30 g/kg hazard level recommended WHO/FAO. Studies on AF levels in corn in Ghana have been few, but studies conducted in neighboring countries of Benin and Nigeria show that AF levels in corn varied by agro-ecological zones and length of storage time. In samples of pre-harvest maize, 98% of the Aspergillus species were A. flavus. The high level of field infestation was reflected in the contaminant levels of the maize in the stores 2 to 3 months after harvest. Ways to reduce risks associated to aflatoxin groundnut contamination are the improvement of post-harvest handling, and the reduction of marketing time. These include pre-storage selection, and proper drying and stacking of the groundnut. The groundnut meal is an important source of aflatoxin, and the major way to reduce the level of contamination is to control the humidity in groundnut storage areas. A number of methods have been suggested for the reduction of AF in groundnuts. Among them are heat, mechanical, electronic and hand picking, chemical, density and flotation techniques, and manual sorting. All these methods have their advantages as well as their disadvantages, plus each one has varying degrees of efficiency. Hence, given the nature of the problem of AF-contamination, the efficiency of the methods used to reduce AF, and the associated costs of the use of these techniques, underlined to reduce AF levels in groundnuts, it is recommended that individuals in the marketing chain, producers, marketers, and consumers increase their awareness of the problem they face with the consumption of AF-contaminated groundnuts, and use individual, hygienic and manual techniques of sorting before consumption to reduce the levels of AF.

Problem Statement

Staples such as maize and groundnut are contaminated with levels of AF that far exceed those considered safe by the World Health Organization/Food and Agriculture Organization. These high AF levels were found in 50%-80% of peanut samples from the Northern and Volta Regions of Ghana. AFs cause carcinoma of the liver in a number of animal species and has been associated with hepatocellular carcinoma in humans, especially in people with hepatitis B infection. AFs also act as immunosuppressive agents and increase susceptibility to infectious diseases in animals. However, the health and economic costs from AF contamination have not been examined in Ghana. Aflatoxin contamination of grains inflicts annual losses of over $750 million in Africa, and is a major economic concern for Ghana. Benin has not been able to export its peanut to Europe because the level of aflatoxin is higher than the mandated European standard. The maximum limit imposed by the Food and Agricultural Organization of the United Nations in 1995 was 30 ppb. The European countries have recently imposed a 4 ppb on groundnut and 2 ppb for corn. These limits, imposed on the levels of food contamination, are considered by many in the developing world as technical barriers to trade that are bound to affect trade flows to a level that will aggravate the worsening food security problems existing in the developing world.

Vision and Approach:

Goals

The goal of the project is to improve the quality of groundnut consumed and traded in Ghana and Benin. In this project we will estimate the health and financial cost of aflatoxin to the agricultural sector and the economy of Ghana and Benin and the risks associated with consumption of aflatoxin contaminated groundnut. The risks associated with various methods of post-harvest, handling and storage will be examined and measures to reduce post-harvest contamination will be evaluated. Most of the contamination of groundnut in West Africa is at the post-harvest stages. Hence reduction of the levels of contamination at the post-harvest stages will influence the levels of intake and the financial and health costs.

Objectives

1. Evaluate the effects of aflatoxin contamination on the profitability of market participants producing and trading groundnut and peanut products in Ghana and Benin.

   b) Evaluate the effects of sorting on peanut costs and returns and the effectiveness of sorting vis-a- vis other methods of reducing the levels

of aflatoxin contamination of groundnut.

c) Evaluate the relationship between aflatoxin levels in groundnut and local foods and certain income, financial and health indicators in Ghana and Benin.

2. a) Evaluate modified commercial storage methods of groundnut for reducing aflatoxin contamination of peanut.
   b) Evaluate the specificity and reliability of methods of identifying contaminated groundnut.
3. Compare the improved storage techniques with the traditional methods of groundnut in reducing the risks of contamination.
   b) Evaluate the risk reducing effects of sorting peanut along the marketing channel and health and financial costs of failing to properly identify aflatoxin contaminated groundnut.
4. a) Determine the factors influencing the adoption of techniques to reduce the levels of contamination in stored peanut.
   b) Evaluate the financial and health risks of consuming aflatoxin contaminated groundnut and the effects on the competitiveness of trading peanut.
5. Estimate the effects of aflatoxin on human health in Ghana and Benin.

Research Approach

The project will continue the studies already began on the effects during the previous five years. Farm and market data will be analyzed to determine the effects of aflatoxin on farm and household income. The effects of aflatoxin risks on marketing will be determined. Since sorting on a small scale is done by the market participants and sorting has been recommended to reduce aflatoxin levels we will determine how reliable this method is in reducing the level of aflatoxin in stored groundnut. We will determine the specificity of the methods recommended to market participants for sorting groundnut. The risk associated to making a mistake in identification of the contaminated nuts will be determined. Technoserve in Ghana has extended to farmers a storage method to reduce aflatoxin contamination of stored grains and groundnuts. We will work with a bio systems engineer from Auburn University to determine the effectiveness of this technique and compare this with the traditional methods presently used by farmers to reduce aflatoxin contamination of groundnut. The financial and health risks of consuming contaminated groundnut will be evaluated. We will work with researchers from UAB in determining the health risks. The data collected will be used to evaluate the effects of groundnut aflatoxin contamination on human health. We will do some mathematical modeling to evaluate the relationship between health parameters and income status of the household.

Training & Capacity Development Approach

The research conducted will enable the host country researchers to improve their scholarly output. As the faculty conducting research increase out-put the standing of the university will improve. The interaction between the farmers and the researcher will increase. We hope to use as many undergraduate and graduate students. As students intermingle knowledge will flow and the students will strive to improve on their educational standing and that of the institution.

Intended Benefits & Impact Responsiveness

Development Benefits

Ghanaians produce large quantities of groundnuts which contribute largely to the protein supply in their daily diet. Groundnuts are also used in their poultry and livestock industries. According to researchers at UST and Food Science Institute, about 37 percent of groundnuts sampled were contaminated with aflatoxin. They also stated that aflatoxin levels can be reduced by proper selection and storage techniques. Through this collaborative effort information on the cost and benefits of adopting storage techniques will be generated. The cost of reducing such contamination will provide useful information to the Ghanaian food industry and the public. Market efficiency gained through proper methods of selection, storage and transportation may reduce the levels of aflatoxin contamination. Hence the examination of the marketing network of groundnuts and groundnut products and the study of the levels of efficiency and the impact on aflatoxin contamination will produce valuable information to Ghanaian groundnut producers.

US Benefits

Though the U.S. groundnuts and groundnut products marketed contain less than the stipulated levels of aflatoxin, according to international standards, there is continuous research to reduce the level to the minimum. Hence technologies generated in other countries capable of reducing aflatoxin contamination and which will reduce storage and marketing costs associated to fungus are important to the U.S. peanut industry. A survey of contemporary literature reveals an increasing wave of aflatoxin contamination of feed and feedstuffs and consequent poisoning of large number of animals especially poultry. The U.S. exports large quantities of groundnut and peanut meal to many areas of the world; there is always the drive to reduce the level of aflatoxin in human and animal feeds. Methods that reduce cost of storage and marketing are always of interest to U.S. peanut industry. Since the level of aflatoxin is not destroyed by processing, U.S. exporters of groundnut will

definitely benefit from information on the levels of contamination of shipped groundnut and peanut products when compared to local groundnut. Cummings has shown that a dollar invested in collaborative research in groundnut generate more than five dollars in net returns to U.S. agriculture in terms of backward flows of information.

Potential Impacts

The project will enhance the institutional capacity of the host institution to evaluate the risks associated to poorly stored groundnuts. As the researchers are trained and diffused knowledge gained from the project they will share this knowledge with their counterparts who will enhance the institutional knowledge base in dealing with aflatoxin. Commercial testing of new storage methods to reduce aflatoxin levels will enhance the capacity of limited resource farmers for storing larger quantities of high quality groundnuts over a longer time period. The improvement and sale of higher quality groundnuts will improve the well-being of the rural poor.

Equipment

End year one vicam machine $5700

Project Timeline

Year 1

February to May 2008

a) Evaluate the effects of aflatoxin contamination on the profitability of market participants producing and trading groundnut and peanut products in Ghana and Benin.

June to September 2008

b) Evaluate the effects of sorting on peanut costs and returns and the effectiveness of sorting vis-a-vis other methods of reducing the levels of aflatoxin contamination of groundnut.

June to December 2008

c) Evaluate the relationship between aflatoxin levels in groundnut and local foods and certain income, financial and health indicators in Ghana and Benin.

Year 2

January to December 2009

a) Evaluate modified commercial storage methods of groundnut for reducing aflatoxin contamination of peanut.

March to December 2009

b) Evaluate the specificity and reliability of methods of identifying contaminated groundnut.

Year 3

January to June 2010

a) Compare the improved storage techniques with the traditional methods of groundnut in reducing the risks of contamination.

March to December 2010

b) Evaluate the risk reducing effects of sorting peanut along the marketing channel and health and financial costs of failing to properly identify aflatoxin contaminated groundnut.

June to September 2010

c) Determine the factors influencing the adoption of techniques to reduce the levels of contamination in stored peanut.

Year 4

January to September 2011

a) Evaluate the financial and health risks of consuming aflatoxin contaminated groundnut and the effects on the competitiveness of trading peanut.

Year 5

January to December 2012

Estimate the effects of aflatoxin on human health in Ghana and Benin.

USAID Mandate Responsiveness

MDGs

Poverty/Hunger: Improved Health: Raised Rural Incomes: Sustainable Development

Foreign Assistance Framework

Governance: Human Capacity: Economic Structure: Persistent Dire Poverty: Global Issues (HIV and Infectious Diseases, climate change, biodiversity)

IEHA

Science and Tech Applications: Increased demand for peanuts: Market Access: Increased Trade

USAID Focal Areas

Greater incomes: Greater value and market demand: Public Health: Food

Security: Sustainable Value Chain: Improved Human Capacity