

Focus 20 • BRIEF 1 • NOVEMBER 2013

Aflatoxins, naturally occurring carcinogenic byproducts of common fungi on grains and other crops, occur more frequently in the tropics, particularly in maize and groundnuts. Persistent high levels of aflatoxins pose significant health risks in many tropical developing countries. In addition, they are also a barrier to the growth of commercial markets for food and feed, including exports. In the European Union (EU) countries and the United States strict standards have been set to minimize aflatoxins on crops consumed in foods or as animal feed. Where aflatoxins are more widespread and costs of mitigation and testing are higher, meeting such standards remains challenging.

Attention to aflatoxin issues from the policy community has increased in recent years, with growing recognition of their health risks as well as the barrier they pose to market development. The 2002 imposition of new, stricter aflatoxin regulations in the EU has raised concerns about the future for African exports of groundnuts and other crops. Local food procurements by the World Food Programme in Africa in 2007 encountered significant levels of aflatoxins, thus raising awareness of potential contamination in food supplies for the poor. The recent formation of the Partnership for Aflatoxin Control in Africa (PACA) demonstrates the commitment of governments and donors to addressing this public health and market development issue.

Because aflatoxins are a pervasive environmental risk, control will require a multifaceted approach. Many different efforts will be required to move toward higher quality food and reduced food safety risk. The briefs in this series thus provide several perspectives on solutions for reducing aflatoxins. The series begins with what is known about the health risks from aflatoxins, as this is the foundation for public health policy. Next, efforts to build new market channels and incentives that can improve aflatoxin control are considered. The international trade and policy context for action in developing countries follows, including how risk analysis might inform policy. Finally, briefs from several CGIAR centers outline how new technologies and new detection methods can overcome constraints to aflatoxin control.

Health risks from aflatoxins

Aflatoxins pose both acute and chronic risks to health. Exposure to aflatoxins is particularly high for low-income populations in the tropics that consume relatively large quantities of staples such as maize or groundnuts. Consumption of very high levels of aflatoxins can result in acute illness and death, as observed in Kenya in recent years (brief 2). It is well established that chronic exposure to aflatoxins leads to liver cancer (especially where hepatitis is prevalent), and this is estimated to cause as many as 26,000 deaths annually in Africa south of the Sahara (brief 3). Other effects of chronic exposure are less understood due to the difficulties in establishing causality when putative effects are correlated with a number of adverse health determinants. Chronic

exposure is associated with immune suppression and higher rates of illness. For infants, exposure is associated with stunting, but the specific role of aflatoxins in stunting has not been identified (brief 4), just as a dose-response relationship has also not been identified. Animal studies provide ample evidence that high levels of aflatoxins in animal feeds have adverse effects for animal health, growth, and productivity. These are suggestive of such effects in humans, but animal studies typically involve much higher levels of aflatoxin exposure than is usually observed in human populations (brief 5).

Using markets to encourage aflatoxin reduction

Markets in developing countries generally do not reward reduced aflatoxins in crops because it is difficult to discern aflatoxin contamination or its risks. The presence of mold is a potential, but highly imperfect, indicator of aflatoxin contamination. Surveys in a few African countries show that farmer knowledge and awareness are far from perfect, as are storage and drying practices (brief 7). While some moldy grain is diverted to uses that somewhat reduce direct human exposure (such as for brewing and animal feeds), quality differentiation based on either market rewards or public standards is still unusual in most developing countries.

Commercial markets can provide incentives for reduced aflatoxins, but this may mean new institutional arrangements to communicate requirements to producers. A comprehensive approach to supply chain management such as that used by Mars, Inc. (brief 6) is a well-integrated, holistic process to better manage aflatoxin risks throughout a supply chain. This kind of comprehensive "from farm to consumer" approach is required even when value chain actors lack the ability to employ sophisticated statistical sampling methods. For example, identification of high-risk elements of the supply chain should help prioritize those areas where market actors can intervene to reduce the incidence of aflatoxins. The World Food Programme's Purchases for Peace program (brief 9) has a simpler approach: the introduction of basic grain quality evaluation tools. These tools can be seen as an essential building block, providing the foundation for quality assessment and evolution toward improved supply chain management.

Another approach is to change handling and processing. TwinTrade, an NGO operating in Malawi, is introducing groundnut shellers, which reduce mold growth and contamination, and is also diverting contaminated product to a new market outlet through peanut oil processing (brief 8). IITA is working closely with Doreo, an NGO operating in West Africa, to introduce aflatoxin biocontrol agents to Nigerian farmers to improve the quality of supply in the feed grain market, thus providing incentives for adoption of this new technology (IITA 2013). Taken together, these market intervention examples suggest that reducing aflatoxins will require changes in both institutions and technologies.

Policy and economic challenges

In addition to the challenge of creating market incentives for reducing aflatoxins, there is also an economic challenge in reducing the costs of control. A wide range of control methods exist, including cultivation practices and postharvest handling. There are also limited means for mitigating effects of exposure. None is in wide use in developing countries due to cost, logistics, and lack of incentives (brief 11). However, preliminary estimates in Kenya show that a simple package of low-cost interventions, such as improved drying and storage, could be effective (brief 10), indicating potential for change if markets reward aflatoxin reduction.

As both a food safety risk and potential barrier to trade, aflatoxins pose challenges that cut across policy sectors. From a public health perspective, the risk assessment framework is widely embraced as the best method for addressing food safety risks (brief 14). Very few risk analyses have been carried out for aflatoxins in developing countries, and this approach could be more widely applied to help focus efforts based on dietary exposure, "hot spots" where aflatoxin levels are particularly high, use of preventative approaches, and communication strategies to reach producers and consumers with risk-mitigation messages.

From a market perspective, it is clear that differences among countries in aflatoxin standards (and ability to meet standards) tend to reduce international trade or to divert low-quality exports to lower-value markets (brief 12). At the international level, Codex Alimentarius standards provide guidance on appropriate levels of aflatoxins, and these serve as an international reference (brief 13). Codex standards are set through an international process of data gathering and consensus building, but more data are needed from developing countries so that standards can be developed that properly reflect risk conditions in diverse circumstances.

Policy initiatives to address aflatoxin control are underway in PACA, in other regional organizations, and in individual countries (brief 15). For example, there are regional approaches to setting standards or to biocontrol registration, which can reduce the costs of individual country action and may promote regional trade.

Promising technologies for aflatoxin control

Because growth of the molds that produce aflatoxins is affected by multiple factors, control is thus complex. Good management

practices in crop production, drying, handling, and storage are necessary but not always sufficient for control (brief 18). Resistant strains can be identified, but resistance is a complex characteristic, and thus considerable research is required for incorporating resistance along with desirable agronomic characteristics for different production environments (briefs 17 and 18). Thus, while some progress is being made, both host resistance and improved management will require long-term efforts in research and extension.

Biocontrol offers a preventative measure to reduce the levels of aflatoxins arising during cultivation and thus during storage as well; it consists of the application of non-toxic fungus strains that outcompete the toxic strains (brief 16). This technology is already in widespread use in the United States and is now being adapted to tropical maize and groundnuts. Field trials indicate that this new technology has potential to reduce aflatoxins substantially at their initial source: in farmers' fields.

Development of new detection and diagnostic tools that are cheaper, more reliable, and more easily used in the field is also underway (brief 19). Such tools would facilitate both public monitoring for aflatoxins as well as the development of commercial markets for improved-quality grain.

Concluding remarks

While there are growing concerns about aflatoxin issues in tropical environments, little is definitively known about their public health risks or about effective market and technology solutions. There is thus a continued need for multidisciplinary and comprehensive research to inform policy and to test potential solutions. Such research can use the tools of risk analysis to better inform policymakers about the scope of public health risks. Given the nature of this food safety risk, solutions need to be evaluated within the context of the entire supply chain. This includes assessing incidence and exposure, evaluating the costs and benefits of control at different intervention points, and testing how interventions could be adopted by different market actors. Such research could identify where market incentives can support improved food safety and better health outcomes for poor consumers.

Laurian Unnevehr (L.Unnevehr@cgiar.org) is a senior research fellow at the Markets, Trade, and Institutions Division of the International Food Policy Research Institute (IFPRI), Washington, DC, and theme leader for Value Chains for Enhanced Nutrition in the CGIAR Research Program on Agriculture for Nutrition and Health (A4NH). **Delia Grace** (d.grace@cgiar.org) is a veterinary epidemiologist and food safety specialist at the International Livestock Research Institute (ILRI), Nairobi, and the theme leader for the Prevention and Control of Agriculture-Associated Diseases in A4NH.



INTERNATIONAL FOOD POLICY RESEARCH INSTITUTE

A member of the CGIAR Consortium | A world free of hunger and malnutrition

2033 K Street, NW, Washington, DC 20006-1002 USA | T. +1.202.862.5600 | F. +1.202.467.4439 | Skype: IFPRIhomeoffice | ifpri@cgiar.org | www.ifpri.org

IFPRI

Copyright © 2013 International Food Policy Research Institute. All rights reserved. For permission to republish, contact ifpri-copyright@cgiar.org.