

AFLATOXINS: FINDING SOLUTIONS FOR IMPROVED FOOD SAFETY

Managing Mycotoxin Risks in the Food Industry: The Global Food Security Link

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In order to bring about true food security, the world must achieve more than the availability of sufficient amounts of affordable and nutritious foodstuffs. It must also ensure that foods are safe. To do so requires going beyond in-factory quality management processes and to instead cover the entire supply chain from “farm to fork.” Food safety incidents involving raw materials can be traced back through all key points of the food production system, including growing, harvesting, storage, manufacture, and distribution. Of these incidents, mycotoxin contamination—of which aflatoxin is the predominant concern—represents the largest proportion of raw material-related food safety issues. This paper will discuss the approach that Mars Incorporated, one of the world’s largest food manufacturers, takes to managing mycotoxin risks throughout its supply chains. It closes by recommending actions to better manage the global challenges that mycotoxins present.

Mars Incorporated’s material quality management process

The need for an integrated, holistic approach to reducing the risk of mycotoxins is clear. The approach adopted by Mars Incorporated, as summarized in Figure 1, includes three essential risk-based steps—crop survey, supplier quality assurance, and factory quality management—plus procedures for strategic sampling, testing, and analysis. Each of these rigorous, science-based steps must be applied according to the particular context, be it climate, growing region, disease, pest infestations, seed selection, and adherence (or not) to good agricultural practices (GAP).

STEP 1 AGRONOMIC DATA AND CROP SURVEYS: FOREWARNED IS FOREARMED

Mycotoxin management starts with the collection of crop-specific agronomic data and regional crop surveillance information for each new crop year. This data will provide information on the potential

mycotoxin distribution, which can be used to perform quantitative risk assessments to direct purchasing strategies, supplier quality-assurance requirements, and sampling/testing protocols (such as mycotoxin types and levels, risk areas, and crops affected).

STEP 2 SUPPLIER QUALITY ASSURANCE: THE FIRST INTERVENTION

Raw material suppliers must understand the potential mycotoxin risks associated with materials they purchase, store, and later sell for feeds or further processing. This includes a solid understanding of regulatory requirements and customer food safety standards to ensure appropriate levels of monitoring, correct storage, and adequate control procedures. A clear specification is essential. Supplier quality assurance works with the raw material supply base to audit and verify the effectiveness of mycotoxin control programs to ensure that potential food safety risks are appropriately managed before the materials are shipped and subsequently received at production facilities. All of these activities should be audited to ensure compliance.

STEP 3 FACTORY GATE AND FINISHED PRODUCT VERIFICATION: THE LAST OPPORTUNITY FOR FORWARD CONTROL

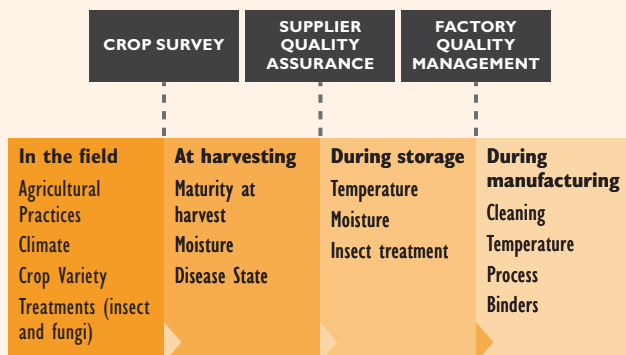
Mycotoxin risk management at the factory level starts with inbound inspection, sampling, and testing as a means of verifying that deliveries meet quality and food safety requirements. This is also risk-based. Information and data from earlier steps in the process are used to direct the extent of sampling and testing done at the factory gate (for example having all inbound trucks or a lesser number evaluated based on the crop risk evaluation). A point of caution is that solely using factory gate testing to accept or reject inbound loads will fail without an understanding of crop and supplier risks. Finished product verification testing must also be risk based, whereby finished products manufactured from higher-risk materials may be evaluated lot for lot, placed on positive release, and subjected to final verification testing prior to market release. Conversely, finished products manufactured from lower-risk materials may not require positive release and can be evaluated at reduced frequency to verify effectiveness of up-front controls.

SAMPLING, TESTING, AND DATA ANALYSIS

Because mycotoxins are not evenly distributed, the sampling strategy needs to be risk based and designed to increase the chance of detecting “mycotoxin pockets” in or across inbound loads. The sample-preparation steps must also be validated to ensure not only that they are compatible with the mycotoxin quantification method employed (HPLC or ELISA) but also that the results are accurate and reproducible within statistical limits.

The accuracy of sample preparation and testing protocols must be routinely verified by a recognized proficiency authority (such as the Food Analysis Performance Scheme or FAPAS) as a means of

FIGURE 1 Material quality management process



Source: Author, 2013.

benchmarking results against other testing laboratories with known mycotoxin types and concentrations. Since mycotoxins are not evenly distributed, the probability of detecting pockets of elevated concentrations in a single truck is low.

Sampling should be performed using manual or automated probes that are inserted at ten points. Each probe is inserted from the top to the bottom of the received load and collected as a continuous core of material. Mycotoxin quantification is performed by analyzing a composite of the ten probes taken from across the received load (per USDA GIPSA recommendations).

As such, each of the components explained above are part of a comprehensive quality management process, which at Mars is structured as summarized in Figure 2.

To maximize the value of each test, it is important to trend mycotoxin test data for each raw material/supplier combination across a rolling 30-lot sample size. This helps to normalize the variance within a single truckload, allowing for a better understanding of material risks and comparison between suppliers of the same raw material. Through both leverage of large volumes of data and collaboration with key partners (such as IBM), we have been able to validate and optimize, through statistical analysis, best practices for sampling and mitigation mechanisms. (A list of supporting references can be found in the appendix section of this publication.)

Conclusions and recommendations

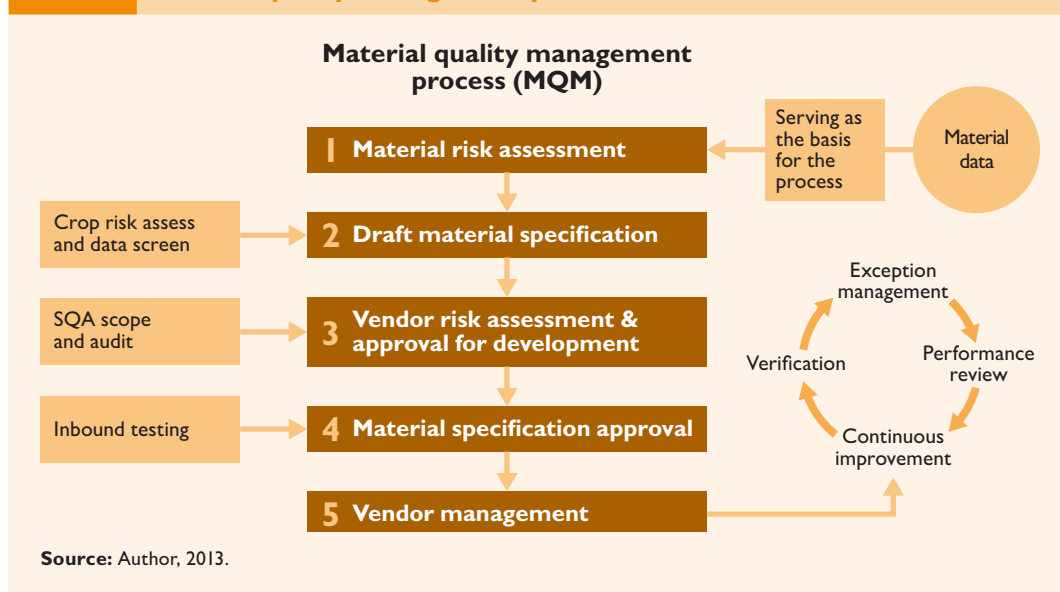
Food safety is a high-level concern for food security. Of the many food safety issues, mycotoxins present a specific and significant challenge to global food security, especially for key food crops eaten by hundreds of millions of malnourished people, particularly those in Africa. The consequences of mycotoxin contamination impact the ability of food companies to use local materials, but overcoming this barrier presents an opportunity for all. We will only be able to drive reliability of supply chains if all manufacturers operate to the same standards and risk management assessments. Mars Incorporated believes that many elements of food safety are pre-competitive, and every day the company generates thousands of data points that, aggregated with other industry

data, have the potential to strengthen operating practices across food value chains. In order to prevent material rejected by one manufacturer from re-entering another's supply chain, we must create a standardized approach to mycotoxins and ultimately to food safety management.

The material quality management process described in this brief is an example of a well-integrated, holistic process that can significantly better manage the challenges and reduce the barriers and consequences that mycotoxins create. Additional policy recommendations could build the needed framework to significantly increase the value of this process and increase the likelihood of reducing the risk of mycotoxins through multidisciplinary solutions.

Obtaining acceptable improvements will require the coordination of a comprehensive and complex network of actions by a wide range of appropriate players from smallholder farmers to multinational food companies and regulators, supported by a "food safety" scientific and policy research agenda promoted by robust food safety management initiatives. Self-regulation—managed through a real-time, open source platform to be accessed by small, medium, and large manufacturers—seems the most reliable and robust way to ensure that the bar for food safety manufacturing practices is raised across the globe. The pressing need to improve the safety of our food supply is clear, and we should further understand how we can make this a pre-competitive space where experience, knowledge, and research should all be fostered for the common goal of achieving a safe and secure food supply for the benefit of farmers and consumers around the world.

FIGURE 2 Material quality management process and hazards verification



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