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Mycotoxins Poisoning In Maize Crop

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INTRODUCTION

Maize (corn) can be susceptible to various toxins, including mycotoxins, which are produced by fungi that can contaminate the crop under certain conditions. Some of the common mycotoxins that can be found in maize include:

Aflatoxins: As mentioned earlier, aflatoxins are produced by Aspergillus fungi, mainly Aspergillus flavus and Aspergillus parasiticus. Aflatoxins are potent carcinogens and can cause liver damage. They are a significant concern in maize production.

Fusarium toxins: Fusarium fungi can produce mycotoxins such as fumonisins, deoxynivalenol (DON), and zearalenone. Fumonisins are associated with various health issues in both humans and animals, including esophageal cancer, neural tube defects, and equine leukoencephalomalacia. DON, also known as vomitoxin, can cause vomiting, feed refusal, and immune system suppression. Zearalenone can have estrogenic effects and cause reproductive issues in animals.

Ochratoxin: Ochratoxin A is produced by various fungi, including Aspergillus and Penicillium species. It can contaminate maize and other crops. Ochratoxin A is a nephrotoxin and can affect kidney function. It has been associated with kidney disease and has potential carcinogenic properties.

Ergot alkaloids: Ergot alkaloids are produced by Claviceps fungi, and their contamination can occur in maize and other cereal crops. Consumption of ergot-contaminated maize can lead to symptoms such as hallucinations, spasms, and circulatory issues.

Toxin levels in maize can vary depending on various factors, including climatic conditions, agricultural practices, and storage conditions. High humidity, temperature, and improper storage can promote fungal growth and toxin production in maize.

The aftermath of an outbreak of an unknown disease in 1961 which killed poultry birds lead to the coining of term ‘mycotoxin’ . It was a major veterinary crisis in England, during which thousands of animals died and was named Turkey X disease. The disease was linked to a peanut meal, incorporated in the

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diet, contaminated with a toxin produced by the filamentous fungus *Aspergillus flavus*.

Mycotoxins are the metabolites having biological activity and it may be expressed by their inhibitory or lethal effects on human or animal health. Unlike bacterial toxins, fungal toxins (mycoatoxins) are not proteins and therefore are not usually detectable by the immune systems of humans and animals. Toxins can remain in the organism after fungus has been removed as due to lack of visible appearance of fungus does not negate presence of mycotoxins.

Wide range of mycotoxins or metabolites is produced by certain fungi such as moulds. There are many species of molds and hundreds of known mycotoxins. Species of mycotoxin-producing molds include *Fusarium, Trichoderma,* and *Stachybotrys.* A single mold species may produce several different toxins, and a given mycotoxin may be produced by more than one species of mold.

Furthermore, toxin-producing molds do not necessarily produce mycotoxins under all growth conditions, with production being dependent on the substrate, temperature, water content and humidity. The mycotoxins probably evolved as a kind of "chemical defense system" to protect the mold from insects, microorganisms, nematodes, grazing animals and human. Nearly 300 different types of mycotoxins formed by 350 species of microorganisms are known. The important among them are alfatoxins, stergmatocystin, ocharactoxin, zearalenone etc. the most widely occurring mycotoxin is alfatoxins.

Aflatoxin is a naturally occurring toxin produced by certain species of fungi, particularly Aspergillus flavus and Aspergillus parasiticus. These fungi can contaminate various agricultural commodities, including maize (also known as corn), peanuts, cottonseed, and tree nuts. Aflatoxin contamination is a significant concern in food

Fungi	Substrate	Mycotoxin
• ***Aspergillus flavus***	Maize, groundnut, oilseed, cotton seed	Aflatoxin
• ***Aspergillus parasiticus***	Maize, groundnut, oilseed, cotton seed	Aflatoxin
• ***Aspergillus nomius***	Maize, groundnut, oilseed, cotton seed	Aflatoxin
• ***Aspergillus ochraceus***	Barley, wheat	Ochratoxin
• ***Fusarium oxysporum***	Wheat, barley, maize	Fumonisins
• ***Fusarium sp.***	Wheat, barley, maize	T-2 toxin
• ***Penicillium verrucosum***	Wheat, barley, maize	Ochratoxin

safety due to its harmful effects on human and animal health.

In the case of maize, aflatoxin contamination typically occurs during the pre-harvest, harvest, and post-harvest stages. Factors such as high temperature, drought stress, inadequate storage conditions, and insect damage can create favorable conditions for Aspergillus fungi growth and aflatoxin production in maize.

Consuming maize contaminated with aflatoxin can lead to acute and chronic health effects. Acute aflatoxin poisoning can cause symptoms such as nausea, vomiting, abdominal pain, fever, and in severe cases, liver failure. Chronic exposure to low levels of aflatoxin over time has been associated with an increased risk of liver cancer, impaired growth in children, immune system suppression, and developmental issues.

To mitigate toxin contamination in maize, it is crucial to implement preventive measures such as good agricultural practices, proper drying and storage techniques, and regular monitoring and testing of the crop. Awareness, education, and adherence to regulatory limits are also important in ensuring food safety and minimizing the risk of toxin exposure from maize consumption.

To address aflatoxin contamination in maize, various strategies can be employed, including:

1. Good Agricultural Practices (GAP): Implementing proper agricultural practices, such as timely harvesting, reducing insect damage, and minimizing exposure to moisture and heat stress, can help prevent fungal growth and aflatoxin contamination in maize crops.

2. Post-harvest Management: Ensuring proper drying and storage conditions for harvested maize is crucial to prevent fungal growth and aflatoxin production. This involves drying maize to a safe moisture level (below 14%) before storage, using appropriate storage containers, and preventing moisture reabsorption during storage.

3. Biological Control: Some non-toxigenic strains of Aspergillus fungi can outcompete toxigenic strains, reducing aflatoxin contamination. The use of biocontrol agents, such as atoxigenic strains of Aspergillus, can be an effective strategy to mitigate aflatoxin contamination in maize.

4. Testing and Regulation: Regular monitoring and testing of maize for aflatoxin levels are essential to ensure compliance with regulatory limits. Many countries have established regulatory limits for aflatoxin in food and feed commodities, including maize. If aflatoxin levels exceed the permissible limits, appropriate measures can be taken to prevent the contaminated maize from entering the food supply.

5. Education and Awareness: Educating farmers, food handlers, and consumers about the risks associated with aflatoxin contamination and promoting good practices can help raise awareness and encourage adherence to proper storage and handling procedures.