



MYCOTOXINS - A THREAT TO CROP, HUMAN AND ANIMAL HEALTH

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Introduction:

A toxin can be defined as a microbial metabolite excreted (Exotoxin) or released by lysed cell (Endotoxin) which in very low concentration is directly toxic to cell of the suscept. (Singh,1990). Toxin is a product of micro-organism or micro-organism host interaction which acts directly on host protoplasts to influence either the course of disease development or symptom expression. Toxin produced by pathogen is two types. (1) Toxins affecting plant health (Pathotoxin, Vivotoxin and Phytotoxin) and (2) Toxins affecting both plant and human health (Mycotoxin).

Mycotoxins are secondary metabolic products from moulds which can grow on the plant either in the field or during storage and are potentially toxic for human beings and animals. More than 300 secondary metabolites have been identified although only around 30 have true toxic properties which raise concerns. These metabolites may contaminate staple foods and feeds worldwide, posing a number of significant food safety concerns. Mycotoxins may be fatal or cause severe illness at very small concentrations. Mycotoxins have significant economic impacts in numerous crops, especially wheat, maize, peanuts and other nut crops, cottonseed, and coffee. Twenty five per cent of the world's crops are affected by mycotoxins each year, with annual losses of around one billion metric tons of foods and food products (Anon., 2008).

Economic impact of Mycotoxin:

(1). Mycotoxins have significant economic impacts in numerous crops, especially wheat, maize, peanuts and other nut crops, cottonseed, and coffee. (2). 25% of the world's crops are affected by mycotoxins each year, with annual losses of around 1 billion metric tons of foods and food products (Anonymous, 2008). (3). Exports of peanuts from Sub-Sahara African countries have declined by as much as 20% owing to mycotoxins contamination. This clearly poses a serious hurdle to international trade in this commodity (WTO Report, 2001). (4). Due to mycotoxin effect in 90,000 tons imported wheat declared unfit for human consumption in Gujarat in 1982 by Food Corporation of India (FCI information Bulletin, 1982).

Economic losses occur because of yield loss due to diseases induced by toxigenic fungi, reduced crop value resulting from mycotoxin contamination, losses in animal productivity from mycotoxin-related health problems, human health costs and additional costs associated with mycotoxins include the cost of management at all levels.

Why are Mycotoxins Important?

Carcinogenic, Teratogenic, Immuno suppressive, Deteriorate quality, Health hazards, Cause economic losses, Marketability, Deadly poisonous and Synergistic with hepatitis B and C viruses.

Factor responsible for mycotoxin production:

- **Environmental humidity:** >70%
- **Temperature:** The ideal temperature for mould development is between 15 and 30 °C, with optimal values of 20- 25 °C. Some species of *Penicillium* can develop in frozen fish at -20 °C. **For example:** *Aspergillus flavus* easily produces aflatoxins at approximately 25 °C. *Fusarium equiseti* can produce T2 toxin at temperatures between 1 to 4 °C. *Aspergillus ochraceus* produces ochratoxin at temperature 20 to 30 °C.
- **PH:** (pH value between 4 to 8)
- **Type of substrate:** Plant origin substrates are better than animal origin for mycotoxin production.
- **Plant stress:** Extremes of temperature or moisture. For **example:** Prolonged draught (3-4 weeks) during seed formation and maturity stages, high atmospheric temperature (30-40 °C) in conjugation with reduced soil moisture produce aflatoxin in peanut (Mehan *et al.*, 1995).
- **Harvest stress:** Late harvest or pre mature harvesting of crop, heavy and continuous rain at harvest and mechanical damage at the time of harvesting, threshing and processing of crop.
- **Storage stress:** Storage products contain more than 9% moisture, wet and humid condition during drying and insect damage to stored products.
- **Crop presence and rotation:** Monocultures or planting of closely related crops one after the other will enhance the risk of mycotoxin formation.
- **Crop variety:** Crop varieties that are more resistant to fungal foliar diseases reduce fungal infection and thus mycotoxin formation.
- **Soil cultivation:** Ploughing practices harbors harvest residues will reduce spore contamination of the subsequent crop and thus reduce fungal infestation and mycotoxin formation and no tillage systems will enhance the risk.

Mycotoxin effect on Human:

Cold/flu-like symptoms, Sore throats, Cirrhosis, Nose bleeds, Carcinoma of liver, Fever, Diarrhea, Headache, Vomit, Jaundice, Dermatitis, Abdominal pain and sometimes it may cause death also.

Mycotoxin Effect on Animal:

Milk contamination, Decreased milk production, Mastitis, Irregular heats, Low conception rate, Ovarian cysts, Embryonic loss, Gastroenteritis, Intestinal hemorrhages, Impaired rumen function, Diarrhea, Ketosis, Decrease feed intake, Lower milk production and Decreased feed efficiency.

Major Mycotoxins:

Aspergillus toxins, *Claviceps* toxins, *Fusarium* toxins, *Alternaria* toxins and Mushroom toxins

Management of Mycotoxins:

For management of Mycotoxin in agriculture commodities knowledge about their fungal sources are needed. The growth of fungi in crops and agricultural products is the main cause of mycotoxin formation. Many factors are involved in enhancing the formation of mycotoxins. They are plant susceptibility to fungi infestation, suitability of fungal substrate, temperate climate, moisture content and physical damage of seeds due to insects and pests.

Toxin-producing fungi may invade at pre-harvesting period, harvest-time, during post-harvest handling and in storage. In general, Management of the contamination of fungi and their mycotoxins in agricultural commodities can be done by various methods. Such as;

Physical methods:

- Drying seeds and commodities to the safe moisture levels.
- Proper storage containers.
- Maintenance of the container or warehouse at low temperature and humidity.
- Keep out insects and pests from the storage
- Treatment of Gamma-irradiation of large-scale commodities

Chemical control: This method includes use of pesticides, fungicides, food additives and food preservatives for control of fungi and its toxin on agriculture commodities.

Cultural methods: This include mixed cropping, use of FYM, Fertilizer, irrigation, proper time of harvesting, method of drying, time of threshing etc for control of mycotoxin in farm condition.

Decontamination and Detoxification: Mycotoxins in foods and feeds can be removed, inactivated or detoxified by physical, chemical and biological means depending on the conditions. However, the treatment has its own limitations, since the treated products should be health safe from the chemicals used and their essential nutritive value should not be deteriorated. The following methods are suggested to be applied for effective decontamination of some mycotoxins.

- Physical separation
- Filtration cum absorption process
- Use of light sources
- Use of organic solvent
- Heat Processing
- Ozone treatment

Integrated Management: Integration of practices such as summer ploughing, seed treatment with carbendazim @2 g/kg seed, furrow application of castor cake enriched with *Tricoderma*, application of gypsum @ 500 kg/ha at flowering stage, spraying of neem oil (2%) at 45 DAS, spraying of carbendazim (0.05 %) + mancozeb (0.2%) at 60-70 DAS, harvesting at 75% pod maturity and removal of damaged pods was very effective in reducing the soil population of *A. flavus*, seed infection and colonization and aflatoxin contamination in groundnut in comparison to farmers practices (Kumar et al., 2009).

General constrains in adopting preventive practices

- ✓ Lack of awareness among the farmers, traders and exporters.
- ✓ Lack of resources with farmers.
- ✓ Rain dependent crop cultivation.
- ✓ Non availability of modern processing technologies.

Conclusion:

Mycotoxins are toxic substances produced by mould and fungi. These toxic substances are by-products of metabolism that are inessential to fungal growth. Although some mycotoxins can be used medical purposes, most are poisonous if eaten in sufficient quantity. Agricultural attention to mycotoxins has focused on corn, nut and fruit crops because of their susceptibility to mold growth and their importance in human diet. Mycotoxins affect several target organs including the liver causing nausea, vomiting, hallucination, anxiety, muscle spasms, diarrhea and hyperactivity. Present seminar provides an overview of economically important mycotoxins that may contaminate livestock feed or human staple foods and threaten the health of humans and domestic animals.. Mycotoxins can be manage at satisfactory level by integration of all possible methods viz; cultural practices, resistant cultivars, timely fungicides application, use of bioagents, as well as harvesting at proper stage and drying by appropriate methods. It can also be detoxify or decontaminated in certain products. Mycotoxin free agricultural trade requires awareness among cultivators and traders.

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