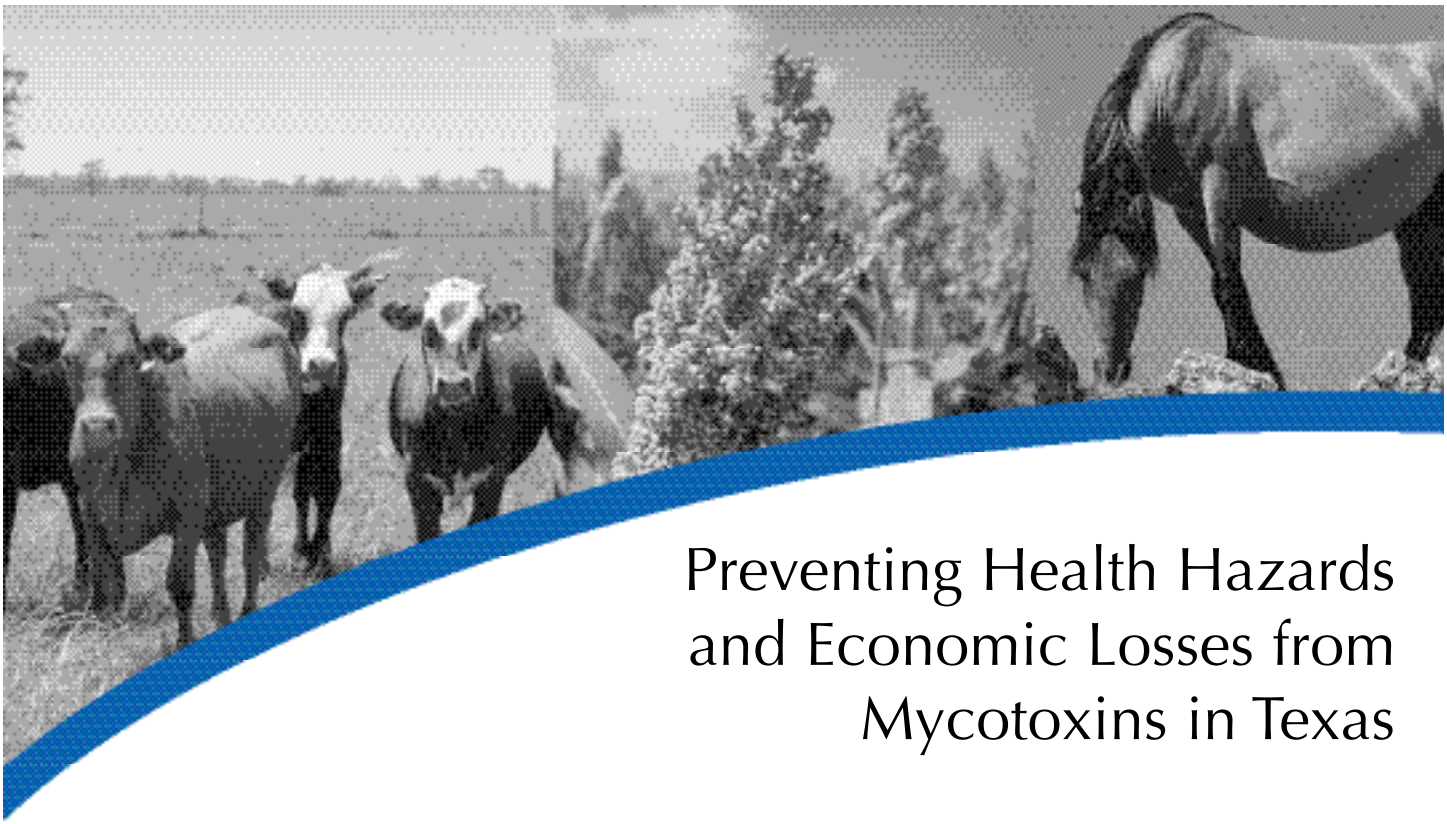


Preventing Health Hazards and Economic Losses from Mycotoxins in Texas

Mycotoxins: Serious Health Threat to Humans and Animals

Mycotoxins are toxic compounds produced by naturally occurring fungi in **grains, nuts,** and **oilseeds** under the typical weather conditions of South and Central Texas. However, mycotoxin contamination can occur in any region of the state. Mycotoxins are a serious health threat to

- **humans,**
- **livestock,**
- **horses,**
- **poultry,**
- **pets,**
- **deer, and**
- **other wildlife.**

Mycotoxins can cause

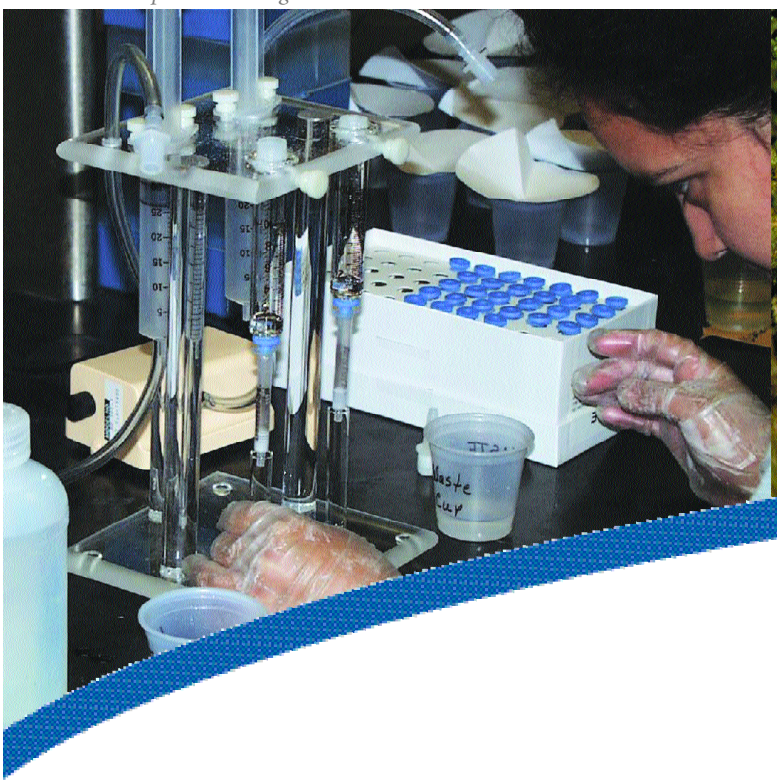
- **low rates of weight gain,**
- **impaired immune systems,** and even
- **death.**

Corn contaminated with aflatoxin.

Corn contaminated with fumonisin.

ABOVE:
Livestock can become ill from mycotoxin-contaminated feed, and milk from infected dairy cows can transmit the toxin to humans.
Sorghum and other grains are susceptible to mycotoxins.
Fumonisin-contaminated feed is a growing threat to the Texas horse industry.

Researchers can identify mycotoxigenic fungi and develop biocontrol agents.



Deer and other wildlife can become ill after eating contaminated feeds offered by well-meaning humans.

Rice, corn, cottonseed, peanuts, tree nuts, grain sorghum, oilseeds, and their products can become contaminated by the toxins. **Aflatoxin**, in particular, is prevalent throughout Texas and is frequently found in corn and cottonseed used for livestock feed. Aflatoxin surveys in 1996 and 1998 showed that more than 50 percent of the counties in each study had one or more corn samples that exceeded the maximum tolerance of aflatoxin.

Wild animals and birds (including large mammals such as white-tailed deer) consuming contaminated feeds purchased by the public as wildlife feed can suffer from impaired immune system function, which can cause death from secondary illnesses.

Milk from cows that consume contaminated feeds can transfer the toxins to humans. People may also consume the toxins through rice, breads, peanuts, peanut butter, and other products. Studies have shown an association between cancer incidence in humans and aflatoxin content in the diet.

Fumonisin, a mycotoxin produced by *Fusarium* spp. in corn and sorghum, is also carcinogenic. Horses are highly susceptible to fumonisin, and the use of infected corn in horse rations frequently results in death of the animals. Thus, mycotoxins constitute a serious and growing threat to the Texas horse industry.

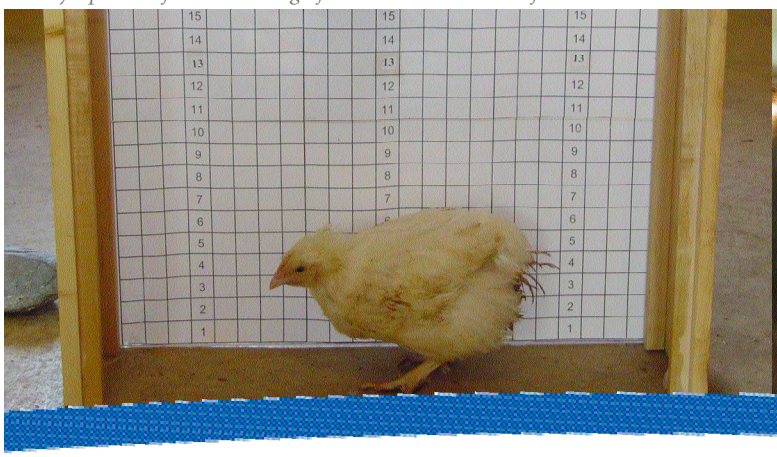
Recently, fumonisin has also been implicated in the upsurge of spina bifida in infants in the Rio Grande Valley. This and other abnormalities, known as neural tube defects, affected numerous babies in the Lower Rio Grande Valley in the late 1980s and early 1990s. Researchers suspect that fumonisin-contaminated corn in the mothers' diet caused these conditions. Fumonisin is known to impede cellular absorption of folic acid, which is crucial in the formation of healthy cells and nervous system.

Economic and Human Costs of Mycotoxins

Mycotoxin contamination of grains and oilseeds endangers the food supplies for both people and livestock in Texas, threatening the economic livelihood of crop producers, ranchers, commercial feed users, and various feed and food industries. A total economic impact has not been developed to quantify the effect of mycotoxins in Texas. However, losses of show dogs, with associated lawsuit settlements by dog food companies; loss of family pets; income losses due to wildlife deaths; and image degradation of Texas commodities—with associated price reductions—have meant losses in the hundreds of millions of dollars. Economic losses are borne by grain and oilseed handlers, distributors and shippers, and feed manufacturers and sellers. Farmers, ranchers, and commercial feeders also bear the economic burden because of poor animal performance, death following immune system damage, and litigation.

One measure of financial losses associated with mycotoxins is a cost of $34 million through litigation from 1990 to 1996. In 1998 alone, corn farmers lost $40 million because of mycotoxins, and in 2002 some 30 million bushels of corn were discounted more than 50 cents per bushel.

A fully grown chicken displays stunted growth and other serious symptoms after consuming aflatoxin-contaminated feed.



The loss of show dogs and family pets because of contaminated feed is an increasing concern.

These economic losses are augmented by the human suffering brought about by birth abnormalities and the death of newborns in the Lower Rio Grande Valley, which researchers suspect were caused by fumonisin.

Solving the Problem of Mycotoxin Contamination

Reducing the adverse impacts of aflatoxin, fumonisin, and other mycotoxins in human and animal diets will have economic, wildlife, and human benefits across Texas. An integrated and focused approach can hasten solutions to the incidence of mycotoxin contamination. Specific components of this proposed multidisciplinary research program include identifying mycotoxigenic fungi, sampling and detecting infestations, and developing more-effective agronomic and management practices regarding these toxins.

The development of crops resistant to mycotoxins, together with the development of sustainable management practices, offers solutions for minimizing the mycotoxin threat. Research is being focused on mycotoxins to develop new technology that will reduce toxic-level contamination of Texas feeds and diminish mycotoxins in crops before and after harvest. This technology offers huge potential benefits to Texas consumers, producers, processors, livestock, and wildlife.

Identifying mycotoxigenic fungi

Research in this area can identify the ecology and abundance of mycotoxin-producing fungi in Texas, establish the potency of toxins in relation to animals and humans, and clearly define the genetic mechanisms and environmental factors that control toxin production.

Because mycotoxin infestations in grains and oilseeds are not uniform, new sampling and detection technologies must be developed to accurately determine toxin levels in the seed at harvest and at subsequent collection points. This will aid both buyers and sellers.

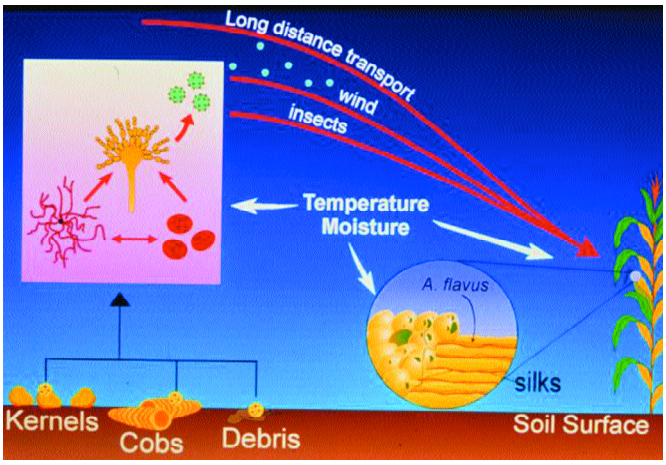
Agronomic practices

Agronomic practices for alleviating the mycotoxin threat include the following:

- Develop new approaches to identify resistance to mycotoxin-producing fungi.
- Support conventional breeding efforts aimed at incorporating resistance into plant germplasm.
- Determine how drought and other environmental stresses influence development of mycotoxins in grain and oilseed crops and design management practices to counteract the process.
- Evaluate cultural practices for better management in the field.

Management practices

Management practices for minimizing the mycotoxin threat include providing a means for suppressing populations of fungi that produce mycotoxins. Locally adapted non-toxin-producing fungal strains that work against mycotoxin-producing fungi will be identified and developed for use as biocontrol agents. **Postharvest**



Aflatoxin can be carried over long distances by wind and insects.

methods include developing and refining handling techniques for grains and oilseeds to minimize mycotoxin production.

Developing mycotoxin-resistant plants

Through plant breeding, scientists can develop germplasm carrying beneficial genetic factors for mycotoxin-resistant traits, with the potential of reducing or eliminating mycotoxins in grains and oilseeds. Researchers can then take advantage of the potential of **genomics and biotechnology** to incorporate resistance to mycotoxin production into susceptible crop species.

Detoxifying mycotoxins

Mycotoxins are destroyed by **ammoniation**, but information about the potential toxicity of resulting metabolites must be determined to gain approval from state and federal health agencies.

Texas Agricultural Experiment Station scientists have shown that certain **clays**, when mixed at low rates with grains, can bind aflatoxin and greatly reduce its effect on animals and humans. The remedy is inexpensive and easily disseminated. Analyses of the molecular structure of the toxin and the clay-specific lattices that can **bind the toxin molecules** have shown scientists how to extend the technology to a range of toxins and clay binders. However, extensive testing and refinement of the technology is needed to identify safe, effective clays and the rates and methods of mixture for each food and feed.

Peanuts and peanut butter can transmit cancer-causing aflatoxin to humans.

Mycotoxins are a serious threat to the poultry industry.

Partners in Mycotoxin Research

- National Corn Growers Association–Mycotoxin Task Force
- South Texas Cotton and Grain Producers Association
- Texas A&M University's Institute of Food Science and Engineering–Center for Food Safety
- Texas Corn Producers Board
- Texas Farm Bureau
- Texas Food and Fiber Commission
- Texas Grain & Feed Association
- Texas Cotton Ginners' Association
- Texas Poultry Federation
- U.S. Poultry and Egg Federation
- U.S. Department of Agriculture–Agricultural Research Service
- Livestock and dairy organizations

Resource Needs

Annual funding of $1 million is needed to bring the benefits of remediation technologies, mycotoxin-resistant crops, and sustainable management practices to address the critical issue of mycotoxins in Texas.

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