TEXAS WILDLIFE
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Aflatoxin: What's a Quail Manager to Do?

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Aflatoxin can occur in any cereal grains, such as corn.

It should come as no surprise that wildlife ranch managers, especially in southern Texas, love their bobwhite quail. Unfortunately, populations of northern bobwhites have steadily declined in the United States, prompting wildlife managers to lend a helping hand by providing supplemental feed. But is feeding quail a well-intended act of kindness or a misguided action?

A problem arises because grain can contain aflatoxin, which is a harmful fungal metabolite of the soil fungi *Aspergillus flavus* and *Aspergillus parasiticus*, both of which can negatively impact quail and other wildlife. Aflatoxin can cause cancer, genetic mutations and birth defects. Aflatoxin also can negatively affect metabolism resulting in weight loss and can reduce immune system functions resulting in poor general health.

Researchers with the Caesar Kleberg Wildlife Research Institute (CKWRI), Drs. Scott Henke, Alan Fedynich and Greta Schuster have been investigating the negative impacts of aflatoxin on wildlife, the exposure risk to various species and lately, what Texans can do to combat this problem. Because it is known that mammals are less susceptible to the effects of aflatoxin than birds and that ruminants are less susceptible than monogastrics, the CKWRI investigators chose to concentrate the majority of their aflatoxin research on birds.

Aflatoxin has always been considered a problem, especially so for human and livestock consumption, but just how serious an issue it was for wildlife was rarely addressed. At the time, Texas Parks and Wildlife Department recommended to avoid feeding grain that exceeded 100 ppb aflatoxin to wildlife. Therefore, the CKWRI research team first wanted to determine what dose of aflatoxin a bird must ingest to experience negative health effects.

What they found was surprising. Doses as low as 25 ppb had deleterious effects. Although aflatoxin did not result in immediate death (within 24 hours of ingestion) until doses exceeded 500 ppb, acute low doses caused a reduction in immune system function in birds. The CKWRI researchers equated the effects of aflatoxin to that of the AIDS virus, both of which reduce immune function to the point where health becomes in jeopardy.

For examples, the researchers implanted one shotgun bb into healthy and aflatoxin-fed quail to mimic a quail getting "feathered' but not killed during the hunting season. A healthy body would be able to produce macrophages to wall off the foreign object and push it out the body much like human bodies do if we get splinters. Unfortunately, quail fed aflatoxin-tainted grain did not have this ability and died within two weeks due to the infection.

The researchers also found that smaller birds, such as northern cardinals, are at greater risk to the effects of aflatoxin than larger birds. They also learned that most bird species could not distinguish between grains that contained aflatoxin from those that were aflatoxin-free. Only green jays were found to have the ability to distinguish between contaminated grain and non-tainted grain; however, to acquire the learned behavior, green jays had to eat large quantities of aflatoxin-tainted grain first,

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which often resulted in sickness followed by death.

The CKWRI researchers continued their work by demonstrating that numerous wildlife species, not just the intended target species, eat grain that ranchers provide and thus, are potentially exposed to aflatoxin. Spreading grain on roads, feeders that throw grain, or animals that spill the contents of feeders onto the ground, all result in a large number of animals and species being potentially exposed to aflatoxin. The potential exposure increases the longer grain remains on the ground. For example, corn spread on ranch roads in southern Texas was consumed by 27 avian, 12 mammalian, and three reptilian species, even though the intended species were only white-tailed deer and bobwhite quail.

Lastly, the research team investigated common grain storage methods of wildlife corn in order to shed light on how to reduce the risk of feeding aflatoxin-contaminated grain to quail. They placed wildlife corn in open air, barn and pavilion environments and in metal, aluminum and plastic containers, which mimicked feeder-type structures. Weekly aflatoxin levels, grain moisture content, daily temperature, relative humidity and dew point inside and outside of each storage structure were monitored.

Each storage type contained corn samples that exceeded recommended aflatoxin levels deemed safe for quail within two weeks, and after eight weeks of storage, aflatoxin concentrations increased significantly in each storage method. However, aflatoxin concentrations fluctuated each week, sometimes reading high levels one week then low levels the next week.

Keep in mind that quantifying aflatoxin can be complicated; the aflatoxin content of grain can appear like a moving target. This occurs because fungi growth on grain does not occur uniformly throughout the entire container. Instead fungi growth, and hence potential aflatoxin production, occurs in hotspots within a container.

If a "hotspot" is sampled, then the aflatoxin content may appear high. However, if a "hotspot" is missed and not contained within the tested sample, then the aflatoxin content of the grain may appear within the safe range to feed to quail. This game of cat and mouse can be frustrating to a rancher who wants to avoid feeding aflatoxin-contaminated grain to quail, but it is a reality that ranchers must understand and accept.

Not all fungal growth contains aflatoxin . Although the ear of corn at the bottom of the photo appears unappealing, it contained much lower aflaxtoin concentrations than the ear of corn at the top of the photograph.

In addition, condensation build-up within metal storage containers increased fungi growth on corn, which subsequently resulted in greater aflatoxin concentrations of corn along the sides of such containers compared to corn sampled within the center of the same container. The grain moisture content must be greater than 13 percent for fungi to grow and hence, produce aflatoxin.

Condensation build-up inside the metal containers increased the grain moisture content of kernels in direct contact with the condensation. Plastic containers performed better than their metal counterparts when considering condensation inside the container.

It has long been espoused that 10 percent bleach solution can be used to clean containers that were contaminated with the *Aspergillus* fungi. However, observations of fungi growth soon after cleaning created doubts in the minds of the CKWRI researchers. Therefore, they tested the efficacy of several commercial cleaning products inclusive of the recommended 10 percent bleach solution.

Again, the results surprised the research community. Ten percent bleach solution was adequate to kill the fungal colony; however, it was not sufficiently strong enough to kill all the fungal spores. In essence, surfaces appeared clean with 10 percent bleach, but colonies were able to reestablish in 3 – 5 days; hence, the recommended concentration did not solve the problem. The CKWRI researchers found that bleach concentrations of 14 percent or greater were needed to kill fungal colonies and their associated spores.

The take-home message for quail managers, at least those with ranches in southern Texas, is to only purchase a quantity of grain that can be fed in less than two months, store your grain in a dry environment, and if quail feeders are used, use plastic-style feeders. On a regular basis wash your feeders with a 14 percent bleach solution and make sure to thoroughly dry the feeders before adding fresh grain. These are just a few suggestions that the CKWRI research team offers to help reduce aflatoxin-associated problems.

For additional information and suggestions, the CKWRI research team developed an aflatoxin management bulletin, which can be found on the website *www.ckwri.tamuk.edu*. Unfortunately the aflatoxin problem won't go away, but these recommendations can help you reduce the exposure of quail and other wildlife to aflatoxin.