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Aflatoxin Levels in Corn Available as Wild Turkey Feed in Georgia

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ABSTRACT: Samples of corn available as wildlife feed from retailers throughout Georgia (USA) were collected during April 1997 and analyzed for aflatoxin to determine if levels harmful to wild turkeys (*Meleagris gallopavo*) were present. Three of 31 (10%) samples collected from a 40-country area were positive. An enzyme-linked immunosorbent assay qualitatively determined that two samples contained from 0 to 20 ppb aflatoxin. A chromatography analysis of a third sample measured 380 ppb total aflatoxin. A small percentage of our sample of wildlife feed collected during one season contained levels of aflatoxin that may cause harm to turkeys, especially poults. However, because aflatoxin levels ranging from 100 to 400 ppb may cause liver dysfunction and immunosuppression in turkey poults and other wildlife, grains known to be contaminated with aflatoxin at levels unacceptable for domestic animal feeds (≥100 ppb) should not be sold as wildlife feed. Further analyses of grains sold as wildlife feed should be conducted to address this potential problem.

Key words: Aflatoxin, *Aspergillus flavus, Aspergillus parasiticus,* baiting, corn, eastern wild turkey, *Meleagris gallopavo.*

Aflatoxins are a group of toxic metabolites produced under favorable environmental conditions by the common molds, *Aspergillus flavus* and *A. parasiticus.* Aflatoxins are found on corn, cereal grains, peanuts, and other foodstuffs, and they may cause disease or death in humans, domestic animals, and wildlife (O'Hara, 1996). The U.S. Department of Agriculture (USDA) regulates food intended for human and domestic animal consumption. The U.S. Food and Drug Administration (FDA) set the maximum acceptable concentration of aflatoxins in corn intended for consumption by humans, dairy cattle, and young livestock at 20 parts per billion (ppb) (Food and Drug Administration, 1989). Acceptable levels for beef cattle, swine, and mature poultry range from 100 to 300 ppb. Currently, grain marketed as wildlife feed is not regulated by the USDA or FDA. It is possible, therefore, that grain that exceeds the acceptable concentrations of aflatoxins set for human or domestic animal use, as determined by the FDA, is being repackaged and sold as wildlife feed. Under natural conditions, wildlife encounter grain contaminated with aflatoxins infrequently. However, a significant mortality event involving geese (>10,000 birds) feeding in Louisiana corn fields that had not been harvested due to high levels of aflatoxin, demonstrated the risk associated with aflatoxicosis in waterfowl (Cornish and Nettles, 1999). Corn and other grains are used frequently as attractants for trapping and translocation, hunting, supplemental feeding, and observation of wildlife. A previous study found that the negative effects of aflatoxins on 4-mo-old eastern wild turkeys (*Meleagris gallopavo*) included lowered feed consumption, reduced weight gains, decreased relative liver weights, and suppression of lymphoblastogenesis (Quist et al., 2000). Our objective was to determine if corn sold to the public in Georgia (USA) as wildlife feed during the spring turkey hunting season contained levels of aflatoxins considered to be harmful to eastern wild turkeys.

We divided Georgia into north and south regions then within each region, we randomly selected 20 counties from which to collect samples of corn sold as wildlife feed. In April 1997, within our 40-county area, we attempted to obtain samples from at least 30 different feed sources or producers that would be representative of suppliers throughout the state. To target corn sold for wildlife feeding, sporting goods, hunting supply, and feed stores in each randomly selected county were approached. One bag of corn labeled as wildlife feed was purchased if it was from a source or producer not yet represented in our samples; if already represented, we continued to the next randomly selected county.

A 100-g, well-mixed representative aliquot from each bag of corn was ground, then a 5 g subsample was tested for aflatoxins with an enzyme-linked immunosorbent assay kit (Agriscreen®, Neogen Corporation, Lansing, Michigan, USA). This assay kit only measured aflatoxin B_1, the most common and toxic of the 4 principal aflatoxin metabolites (B_1, B_2, G_1, and G_2). Results were compared to a 20 ppb aflatoxin control to qualitatively determine a positive or negative sample by color differences. Fifty g of each positive sample were further analyzed to quantify specific aflatoxin metabolite level using two dimensional thin layer chromatography (Jain and Hatch, 1982).

We obtained 1 bag of corn from each of 31 different sources or producers within our 40-county area. The enzyme-linked immunosorbent assays detected 28 negative (0 ppb aflatoxin) samples. Two samples were positive, with aflatoxin levels between 0 and 20 ppb. One sample was strongly positive ($\geq$20 ppb), and the subsequent two dimensional thin layer chromatography analysis detected 380 ppb total aflatoxin. Specifically, this latter sample contained 345 ppb aflatoxin B_1 and 35 ppb aflatoxin B_2. No G_1 or G_2 aflatoxins were detected.

Corn labeled as wildlife feed was available at feed stores in all 40 counties that we visited in Georgia during spring (March–May) 1997. Three of 31 samples (10%) of corn tested positive for aflatoxins. The level of aflatoxin (380 ppb) in one sample was within the range (100–400 ppb) found to negatively affect wild turkey poults (Quist et al., 2000). Effects of high levels (400 ppb) of aflatoxin on 4-mo-old wild turkey poults included decreased weight gains, liver damage, and immunosupression. Giambrone et al. (1985a) recorded suppression of cell-mediated immunity in day-old domestic turkey poults fed 100 ppb aflatoxin, and 100% morbidity and mortality in birds fed 500 ppb and 1000 ppb aflatoxin. Fourteen-day-old domestic poults fed 100, 200, 400, or 800 ppb aflatoxin experienced decreased weight gains and feed conversion, and signs of aflatoxicosis such as blood-clotting abnormalities and immune dysfunction, were apparent in birds fed 100 ppb aflatoxin (Giambrone et al., 1985b).

The susceptibility to aflatoxicosis is affected by factors such as species, age, and individual variation (Pier, 1992). Ducklings, turkey poults, and goslings are more sensitive to aflatoxin than quail and domestic chicks (Muller et al., 1970). White-tailed deer (*Odocoileus virginianus*) fawns reacted to aflatoxin by reduced feed consumption, decreased body weights, and decreased liver function when fed 800 ppb aflatoxin for 8 wk (Quist et al., 1997).

Aflatoxin may be present in grain before harvest, during storage, or after the grain is placed in the field as wildlife food or bait. Fischer et al. (1995) found that 51% of 39 corn samples collected from bait piles in the field contained aflatoxin levels that ranged from 20 to 750 ppb. Factors such as drought stress, disrupted seed coat, corn left after maturity, competition with weeds, and insect damage cause increased growth of *Aspergillus flavus* and *A. parasiticus* (Cheeke and Shull, 1985). Ground corn lacking preservatives has no natural barrier to *Aspergillus* infestation that may facilitate production of aflatoxin (Pier, 1992).

Our data from one field season suggest that there is a low probability (10%) that aflatoxins are present in corn sold as wildlife feed in Georgia. However, factors influencing production of aflatoxins in grain differ annually and by storage time and conditions (Thompson and Henke, 2000), and we may have sampled wildlife feed when conditions were not favorable for production of aflatoxins. This and other studies have found that aflatoxin levels present in some corn available as wildlife feed, waste corn in fields, and corn set out as bait or supplemental food are high enough to cause harm to poults and other young wildlife (Couvillion et al., 1991). Because this study was limited in scope, further testing should be performed on grain available as wildlife feed and used as bait or supplemental food, as this grain currently is not subject to USDA or FDA regulations. Grain that exceeds FDA standards for human (≥20 ppb) or domestic animal (100–300 ppb) consumption should not be repackaged and sold as wildlife feed because similar levels of aflatoxins have been shown to pose health risks to wildlife populations.

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LITERATURE CITED

CHEEKE, P. R., AND L. R. SHULL. 1985. Natural toxicants in feeds and poisonous plants. American Veterinary Institute Publishing Co., Inc., Westport, Connecticut, 215 pp.

CORNISH, T. E., AND V. F. NETTLES, JR. 1999. Aflatoxicosis in Louisiana geese. Southeastern Cooperative Wildlife Disease Study Briefs 15: 1–2.

COUVILLION, C. F., J. R. JACKSON, R. P. INGRAM, L. W. BENNETT, AND C. P. MCCOY. 1991. Potential natural exposure of Mississippi sandhill cranes to aflatoxin B_1. Journal of Wildlife Diseases 27: 650–656.

FISCHER, J. R., A. V. JAIN, D. A. SHIPES, AND J. S. OSBORNE. 1995. Aflatoxin contamination of corn used as bait for deer in the southeastern United States. Journal of Wildlife Diseases 31: 570–572.

FOOD AND DRUG ADMINISTRATION. 1989. Corn shipped in interstate commerce for use in animal feeds; action levels for aflatoxins in animal feeds—Revised compliance policy guide; availability; FDA's policy on blending of aflatoxin-contaminated corn from the 1988 harvest with non-contaminated corn for use in animal feeds. Federal Register 54, Volume 100, U.S. Government Printing Office, Washington, D.C., pp. 22622–22624.

GIAMBRONE, J. J., U. L. DEINER, N. D. DAVIS, V. S. PANAGALA, AND F. J. HOERR. 1985a. Effect of purified aflatoxin on turkeys. Poultry Science 64: 859–865.

———, ———, ———, ———, AND ———. 1985b. Effects of aflatoxin on young turkeys and broiler chickens. Poultry Science 64: 1678–1684.

JAIN, A. V., AND R. C. HATCH. 1982. Two dimensional thin layer chromatography of aflatoxins. *In* Advances in thin layer chromatography, J. Touchstone (ed.). John Wiley and Sons, Inc., New York, New York, pp. 363–373.

MULLER, R. D., C. W. CARLSON, G. SEMENIUD, AND G. S. HARSHFIELD. 1970. The response of chicks, ducklings, goslings, pheasants, and poults to graded levels of aflatoxins. Poultry Sciences 49: 1346–1350.

O'HARA, T. M. 1996. Mycotoxins. *In* Noninfectious diseases of wildlife, A. Fairbrother, L. N. Locke, and G. L. Hoff (eds.). 2nd Edition, Iowa State University Press, Ames, Iowa, pp. 24–30.

PIER, A. C. 1992. Major biological consequences of aflatoxicosis in animal production. Journal of Animal Science 70: 3964–3967.

QUIST, C. F., D. I. BOUNOUS, J. V. KILBURN, V. F. NETTLES, AND R. D. WYATT. 2000. The effect of dietary aflatoxin on wild turkey poults. Journal of Wildlife Diseases 36: 436–444.

———, E. W. HOWERTH, J. R. FISCHER, R. D. WYATT, D. M. MILLER, AND V. F. NETTLES. 1997. Evaluation of low-level aflatoxin in the diet of white-tailed deer. Journal of Wildlife Diseases 33: 112–121.

THOMPSON, C., AND S. E. HENKE. 2000. Effect of climate and type of storage container on aflatoxin production in corn and its associated risks to wildlife species. Journal of Wildlife Diseases 36: 172–179.

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