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Aspergillus flavus occurs worldwide in diverse habitats on a variety of plant and animal substrates. In the United States, contamination of susceptible crops particularly maize, peanuts, cottonseed, and tree nuts has become a major health concern because of the development of the carcinogen, aflatoxin. Extensive research into all aspects of the biology of A. flavus over the past twenty years still has left many unanswered but very basic questions about the ecology of this important organism.

Preharvest aflatoxin contamination of corn is of annual concern in the southeastern U.S., while in the midwest it occurs more sporadically. This unpredictability, however, causes much confusion, disruption and economic loss to the grain trade in years when aflatoxin is prevalent. In order to effectively manage the problem, a clear understanding is needed of how and where A. flavus survives in the years between aflatoxin outbreaks and the circumstances under which populations of the fungus explode in epidemic years.

In the last few years progress has been made in identifying sources of A. flavus inoculum in Iowa corn fields and relating populations of the pathogen to tillage and rotational practice. A study carried out in conservation tillage plots in northern Iowa over the period 1979-80, indicated that A. flavus was present in the air, soil and on new plant tissues during the growing season. Recovery of A. flavus from these sources could not be related to tillage practice. In 1991 and 1992, the same experiment was repeated in these plots after an 11-12 year period during which time the plots were managed according to the protocols established when the plots were originated in 1977. The data in these later years was in very close agreement with the earlier results, indicating that population counts in soil, air or on growing plants were not influenced by tillage or rotational practice. There was some indication, however, of a population build-up on

crop residues in continuous corn plots under minimum tillage. This is the cultural practice under which this trend would be expected.

Another component of the Iowa study has been a biannual survey of 40 Iowa corn fields that experienced significant aflatoxin contamination in 1988. Samples of soil and corn debris have been taken in the spring and fall of each year and tested for the presence and characteristics of A. flavus. These data showed a recovery rate of A. flavus from crop residues of the order of 70% for samples taken within one year of the 1988 epidemic, but in the following year these populations crashed to a recovery rate of 0.1%, and have remained at that level since.

The data from the long-term tillage plots and the field surveys indicate that there is a low background population of the fungus that is widely distributed in the soil and crop residues in Iowa corn fields. These persist at low levels in years not favorable for development of aflatoxin. The work did not reveal any concentrated sources of the pathogen in the field environment. These were found, however, in a survey of corn cribs and storage bins throughout Iowa in 1991 and 1992. A. flavus was readily detected sporulating on piles of waste kernels close to the bins and cribs.

A series of tests were carried out to establish waste corn as an inoculum source for the pathogen and to determine how it might be disseminated. Visible sporulation of A. flavus was detected on deposits of waste corn at all 16/17 cribs and 4/5 storage bins examined in 1991 and 1992. Airborne inoculum of A. flavus was detected at 9/14 cribs and at 4/5 bins tested. These values were as much as 20 times greater than typical spore count obtained in corn fields. The data indicated that there was extensive A. flavus inoculum on waste corn and in the air at cribs and bins throughout Iowa, and that the degree of infestation of the fungus varied among sites. This could be related to the degree of sanitation around the storage site.

In order to determine if inoculum of A. flavus on waste corn can be transmitted by air and nitidulid beetles to neighboring corn fields, an intensive study was made in 1992 at two cribs surrounded by waste corn at Cedar Rapids and Williamsburg, Iowa. Airborne spores of A. flavus and nitidulid beetles were trapped at different times and at various distances from the deposit of waste corn into an adjacent corn field. At the same time, measurements were made of A. flavus-infection of leaves and silks on corn plants at different distances from the source. A second experiment was carried out in replicated field plots at Ames, IA in which piles of waste corn were brought in from a naturally contaminated site and placed in the middle of plots. Corresponding non-infested plots were paired with infested plots and each plot was replicated four times. Measurements were made of airborne spores, insects and infection of leaves and silk at different times during the season.

At each of the three locations, a distinct gradation in spore density and plant infection in relation to distance from the waste corn was established. These data provided strong evidence

that waste corn was an inoculum source of A. flavus and that the fungus is dispersed in the air to infect corn plants.

Insect trapping showed much higher nitidulid beetle counts occurred at 2-6 m from waste corn deposits than at further distances. Substantial percentages of these insects were infested with A. flavus, The data indicated that waste corn was a major source of A. flavus-contaminated nitidulid beetles.

If it can be established that A. flavus on waste corn is a major inoculum source for the development of aflatoxin in corn fields, an effective and economic control practice for this disease could be easily applied by cleaning up waste corn deposits on farms.