Storage Fungi and Mycotoxins — Session Summary

Conveners: A.D. Hocking and J.D. Miller

The sessions dealing with mycotoxins and toxigenic fungi covered one day beginning with a keynote address and ending with a special mini symposium on fungal ecology in relation to mycotoxin prevention. This is a challenging time for the grains industry in all countries because of the discovery of an important new mycotoxin in maize, fumonisin. Discovered in 1988, fumonisin is widely distributed in maize grown under hot, dry conditions. It is a rodent carcinogen and causes specific toxicoses in horses, swine and young poultry. Guidelines for fumonisin exist for animal feed in some states of the USA. Guidelines for food are expected in 1994 in the USA and Canada. Additionally, there is increasing recognition of the economic consequences of mycotoxin occurrence in grain. Under many circumstances, the economic losses caused by mycotoxins produced in the field or in storage or both are much larger than the value of the crop itself.

There are five agriculturally-important mycotoxins: the *Fusarium* toxins deoxynivalenol, zearalenone and fumonisin, aflatoxin and the *Penicillium* mycotoxin ochratoxin. All of these mycotoxins cause animal disease and have major effects on animal productivity. Additionally, there is widespread human exposure to deoxynivalenol, fumonisin and aflatoxin with consequent effects on human health. The regulation of mycotoxin tolerances in international trade is a major factor in limiting market access for some countries. The combined economic effects of one mycotoxin, aflatoxin, was reviewed in an innovative contribution by Lubulwa and Davis (ACIAR, Australia).

The design of appropriate storage and transport systems for grains is increasingly dependent on knowledge of the biology of the biota contaminating stored grain. Insects affect fungal colonisation of grain and hence toxin production in storage primarily by redistributing moisture. This was illustrated by useful presentations by Dharmaputra and colleagues from Indonesia and A.K. Sinha from India. On the other hand, mycotoxins produced in the field can affect stored product insect populations. The accumulation of perhaps unimportant concentrations of storage toxins (aflatoxin, ochratoxin) results in mixtures of field and storage toxins. These can act synergistically further affecting the stored product ecology and the end user of the crop. Pitt (CSIRO, Australia) reviewed landmark studies of the fungi found on food-grade commodities in several Asian countries. These demonstrated that contamination by more than one toxigenic mould was common.

Although it is clearly understood that dry grain cannot support fungal growth, beyond this generality, little can be said. The development of models to predict the tolerance of commodities to short periods of sub-optimal storage as well as to new storage practices requires more basic information on fungal growth and toxin production. In the several interdisciplinary discussions that took place during the mycotoxin sessions, this lack was pointed out several times. Gibson and colleagues from the CSIRO, Australia provided information on possible directions in this area.

A major thrust of the mini symposium was the basic ecology of the toxin producing fungi. Although ochratoxin and aflatoxin are primarily storage mycotoxins, the source of the fungi is the field. Siriacha and colleagues at the Department of Agriculture, Thailand described this aspect in subtropical maize production. In this case, a very high percentage of kernels are contaminated from the earliest stages of plant development by *A. flavus*. For temperate maize production, Wicklow (USDA, Peoria) outlined the importance of understanding the role of insects as sources

of *A. flavus* inoculum in maize. The importance of strategies to manage fungal contamination before the crop reaches storage and the artificiality of the boundary between field and stored product research were emphasised.

Other contributions dealt with the distribution and detection of mycotoxins and toxigenic moulds in commodities in Asia, Europe and South America. These affirmed the worldwide nature of this difficult problem. Mycotoxin-related issues were discussed in many sessions across disciplines, The hope was expressed that at the time of the seventh conference that more information on the biology of toxigenic moulds would be available for engineers to model storage and transportation systems.