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"Resilience of agricultural systems against crises"

A Review of Computational Methods for the Design of Innovative Drying Systems for the Prevention of Postharvest Aflatoxin Contamination of Maize in Kenya

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Abstract

Maize (*Zea mays* L.) is the preferred staple food crop in Kenya. It is grown in all agro-ecological zones and on two out of every three farms and accounts for about 40 percent of daily calories with an annual per capita consumption of 98 kilograms. Aflatoxin contamination of maize is a recurrent problem in Kenya. In 2004 and 2005 alone 157 deaths were documented and in 2010, 2.3 million bags of maize grown in the Eastern and Coastal regions were declared unfit for human consumption by the Ministry of Public Health and Sanitation due to unacceptably high levels of aflatoxin contamination. Kenya is yet to attain food self sufficiency and enhancing the resilience of the maize production system to aflatoxin contamination is necessary for food security.

Aflatoxins are produced by the fungi *Aspergillus flavus* and *parasiticus*. They are known carcinogens and have also been shown to be antinutritional, mutagegenic, teratogenic and immuno suppressants. The risk of aflatoxin contamination is enhanced during growth by prolonged moisture and nutrient stress conditions and also by exposure to high humidity and temperature in the harvest/post harvest period. Climate change, evidenced by erratic rainfall distribution during the crop cycle, is responsible for the escalation of both these risk factors and poses a significant challenge for the management of aflatoxin contamination. The optimal temperatures and water activity for the growth of *A. flavus* and *A. parasiticus* is 35–37°C and 0.95 respectively, and for aflatoxin production, between 28–33°C and 0.90–0.95 respectively. This paper reviews documented numerical simulations of low temperature drying of maize and assesses the suitability of the provided partial differential equations, modelling heat and mass transfer, on the basis of their accuracy, range of application and ability to predict the occurrence of high aflatoxin contamination risk factors in drying.

Keywords: Aflatoxin contamination, computational methods, maize drying, post harvest loss management

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