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Assessing Meteorological Risk Factors for Aflatoxin Contamination of Maize Dried on Small Farms in Kenya

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Abstract

Kenya lies within the Equatorial tropics of East Africa and is renowned globally as a world hot-spot for aflatoxins, i.e. toxic and carcinogenic compounds associated with fungal colonisation of foods. Contrary to the general belief that there is enough "sunshine" in the equatorial tropics to dry foods, farmers in Kenya are struggling with delayed and insufficient dehydration that accounts significantly for the high prevalence of mycotoxins in maize supplies. All the major outbreaks of acute aflatoxicosis in Kenya have occurred during recurrent El Niño episodes arising from sea surface temperature anomalies in the tropical pacific. El Niño in Kenya has historically been associated with intensification of the October, November, December rains, often extending to February and thereby coinciding with most of the country's maize harvest across the different agroecological zones.

The prevalence of pre-and postharvest aflatoxins is skewed both locally and globally, stemming from locational differences in the altitude and latitude at which maize is grown. Generally, high outdoor night temperatures exceeding 22oC are considered high risk for pre-harvest aflatoxins in maize. In this study, psychrometric data was obtained from 14 different weather stations located within maize growing zones, i.e. 10 stations in Kenya (equatorial-East Africa), 1 in Ghana (equatorial-West Africa), 2 in the USA and 1 in Germany (locations outside the tropics). The elevations of the stations varied from 55 m to 2115 m above sea level. The assessed data included hourly recordings of relative humidity, dry bulb, wet bulb and dew point temperatures and descriptions of relative cloud cover and occurrence of thunderstorms, rains, frosts and fog, taken for the month of November 2015, to coincide with a peak in extreme wet weather presented by the latest El Niño episode in Kenya. The results associated higher risks for pre-harvest aflatoxin contamination of maize dried under extreme weather with the equatorial lowlands, where typical indoor conditions occur outdoors at night. Fumonisins and not aflatoxins were observed to be the bigger threat for pre-harvest in the cooler equatorial highlands. Heavy rains and the associated build-up of clouds impede sun-drying and investment in artificial driers is inevitable to mitigate mycotoxins in Kenya's maize.

Keywords: Aflatoxins, maize, mycotoxins, sensor-psychrometrics, sun-drying

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