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Aflatoxin and Fumonisin Contamination of Maize and Deans Along the Food and Feed Value Chain in Babati District

Abstract

The natural occurrence of aflatoxins and fumonisins in maize and beans at harvest, during storage and along the value chain, including processed, feed and marketed products in three villages of Long, Sabilo and Seloto in Babati District, Manyara region, Tanzania, was investigated in the year 2013/14. The selected villages represent three different climatic zones. Total aflatoxin and fumonisin contamination levels for 440 harvest maize samples had levels as high as 26.2 µg/kg and 46 mg/kg, respectively. Aflatoxin contamination in 38 common beans samples had levels as high as 3 µg/kg. Aflatoxin and fumonisin contamination in all beans samples were within the maximum tolerable limits (MTL) of 10 µg/kg for aflatoxins and 2 mg/kg for fumonisins which were established by East African Commission (EAC, 2011b). Parameter estimates from the generalised linear model (GENMOD) indicated that the medium altitude (1500 – 1800 metres above sea level (m.a.s.l), low rain zone was most predisposed to maiz aflatoxin contimation [Sabilo village (0.26). Early planting (-0.22), hand hoe tillage (−0.59) and ox tillage (-0.55) were the major factors associated with reduced aflatoxin contamination.

The high altitude (2150 -2450 m.a.s.l.), low rain zone was the least predisposed to maiz fumonisin with a parameter estimate of -2.93. Total aflatoxin and fumonisin levels were measured for 574 maize and 106 bean samples stored by 60 farmers over a period of 180 days from August, 2013 to March, 2014. Maize samples from Seloto village were more contaminated (mean value of 3.24 µg/kg) than those from Sabilo village (mean value of 3.12 µg/kg). Factors most associated with higher aflatoxin contamination were storage for 0 to 80 days and storage with other crops. For fumonisin they were storage of maize in granaries as opposed to storage in polypropylene and improved bags. The storage technique that had the highest risk of aflatoxin development was polypropylene bags with no insecticide treatment (control). It had with a mean contamination value of 3.57 µg/kg. The use of polypropylene bags with insecticide and pesticide treatments which were most commonly used by farmers had a mean value of 3.30 µg/kg. Lower aflatoxin levels were related to the use of traditional storage insecticides, sorting, and storage in improved bags. Among the maize and beans samples collected from market vendors and from small-scale mill processors were whole maize grains, maize flour, feed (maize bran and poorly sorted maize not fit for human consumption but normally fed to animals) produced locally from the three villages. Maize bran had highest levels of aflatoxin with a mean value of 2.38 µg/kg and poorly sorted maize bran had the highest fumonisin mean value of 7.42 mg/kg, followed by whole maize with a mean aflatoxin value of 1.73 µg/kg and maize bran with a fumonisin mean value 1.02 mg/kg. Dehulled maize was least contaminated with fumonisin. Mycotoxins become concentrated in bran that most commonly is used for animal feed during milling. They are less concentrated in maize flour and dehulled maize that are normally used for human consumption. All animal feed grade grain materials had MTL levels below 20 µg/kg for total aflatoxin and a range of 5 to 100 mg/kg for total fumonisin (FAO, 2004; FDA, 2001). The use of best practices along the commodity value chain can reduce contamination in order to improve food and feed safety.