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Evaluation of Hermetic Technologies in Controlling Insect-Pests, Mould Infestation and Aflatoxin Contamination of Stored Maize

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Abstract

Hermetic storage technologies, as a food-insecurity intervention, create a bio-generated atmosphere that offers a safe and reliable storage solution for maize grains. There are many studies about their effectiveness against post-harvest pests in SSA but little information exists on their effectiveness against mould and mycotoxin infestation. Furthermore, previous studies have not compared the performance of hermetic technologies with the conventional synthetic pesticides and their effectiveness against both mould proliferation and insect infestation. Trials simulating African smallholder farmer conditions were conducted in the postharvest laboratory at Kiboko (a semi-arid area in Kenya) and at University of Nairobi laboratory for 8 months during the 2017 storage season. There were eight hermetic treatments (metaland plastic silo, and 6 brands of hermetic bags) against two non-hermetic treatments (a registered synthetic pesticide and untreated control, in polypropylene bags. Maize grains were subjected to two levels of moisture (12–13 % and 14–15 %) and two levels of natural and artificial fungal inoculation (*Fusarium* and *Aspergillus*). Treatments were arranged in a RCBD. The study found that hermetic treatments were significantly superior to non-hermetic treatments in the prevention of mycotoxin, and fungal development among other benefits. However, there were no significant differences between metal silos and hermetic bags regardless of the mode of infestation. The aflatoxin levels were not significantly different in the dry inoculated grain, across all the storage technologies ($p = 0.05$) compared with the baseline levels. This indicates that, within 8 months of storage, mould proliferation is not likely in dry grain stored under hermetic conditions. However, in the innoculated grains with high moisture, there was an increase in aflatoxin levels in both hermetic and in the control by 5.7 ppb and 12.1 ppb, respectively. At high levels of moisture, the grain is likely to be contaminated by the mycotoxins in both hermetic and conventional storage technologies. There was a strong correlation between total insect and fungal population per kg which indicate the importance of controlling insect pest during storage to reduce losses. Also, fungal population and mycotoxin levels increased exponentially with moisture increase in the non-innoculated grains. *Aspergillus* and *Fumonisin* spp. were higher in the controls compared with the hermetic storage technologies hence low oxygen reduced fungal proliferation.

Keywords: Food insecurity, fungal inoculation, hermetic storage, mycotoxins, post-harvest insects

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