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Developing an Aflatoxin Biocontrol Product Against Aflatoxin-Producing *Aspergillus spp.* in Zambia

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Abstract

Food quality and safety issues resulting from widespread aflatoxin contamination is an obstacle to improved health status and livelihoods of smallholder maize and groundnut farmers, and hampers their linkages to markets in Zambia. Produced by toxigenic isolates of *Aspergillus* section Flavi, aflatoxins are highly toxic carcinogens associated with stunting and immune-suppression. The International Institute of Tropical Agriculture (IITA) and its partners have developed the environmentally friendly and cost-effective biocontrol product aflasafe for minimising aflatoxin levels in highly susceptible crops. However, knowledge on *Aspergillus spp.* community structure is limited and there is a need to understand the interaction between aflasafe and *Aspergillus* in the soil to interpret product performance. The main aim of this study was to establish the relationship between aflasafe and the soil community profile of *Aspergillus spp.*, and their potential effects on aflatoxin levels in maize and groundnut. In an on-farm research trial, two candidate aflasafe biocontrol products, comprising of non-toxin-producing *A. flavus* strains were applied in maize and groundnut fields, 2–3 weeks before flowering at a rate of 10 kg ha^{-1}. Soil was sampled prior to aflasafe application and 3 months after crop harvest, while crops were collected at harvest. Microbiological assessments were performed for soil and grain, and aflatoxin assessment for grain, from both treated and control fields. Our results showed that high aflatoxin producing S-morphotypes and *A. parasiticus* formed the most predominant component of *Aspergillus spp.* (85.7 %) in soils cropped to maize and groundnuts. Consequently, heavy aflatoxin loads (>20 ppb) were detected in untreated grains, especially groundnuts. Treating maize and groundnut fields with aflasafe altered *Aspergillus spp.* soil community structure leading to a significant reduction in aflatoxin levels by 89.6 % compared to control fields. Thus, the biocontrol holds great promise for fighting the aflatoxin burden on maize and groundnut in Zambia. Adoption of the biocontrol products aflasafe ZM01 and aflasafe ZM02 to address aflatoxin could sustainably improve grain nutritional quality and safety for better health and greater income of Zambian smallholder farmers.

Keywords: Aflasafe, aflatoxin, food safety, groundnut, maize, Zambia

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