Flagship 3: Food Safety

Highlight 2: Proving Efficacy of Nigeria’s Aflatoxin Biocontrol Product: Results from a 10-Year Study

An A4NH-supported partnership led by the International Institute of Tropical Agriculture (IITA) has developed, tested, and adapted aflatoxin biocontrol for Africa south of the Sahara for more than 18 years. Aflatoxin contamination of crops, especially maize and groundnut, is common in this part of Africa, with profound negative impacts on personal, social, economic, and national development opportunities. Exposure to aflatoxins, which occurs predominantly through food, can have devastating effects, including reduced growth and weakened immune systems in children and liver disease and cancer in adults. Moreover, farmers cannot sell crops contaminated above tolerance thresholds in premium markets, impacting income and trade.

Aflasafe®, the aflatoxin biocontrol technology developed by IITA and partners, employs a deceptively simple natural principle: raising the proportion of *Aspergillus flavus* strains incapable of producing aflatoxins (called atoxigenic) in a field lowers aflatoxin accumulation in crops produced there. Aflasafe increases the frequency of native atoxigenic strains in the field before the aflatoxin-producing strains become established, creating an aflatoxin-safe environment. The development process began in Nigeria in 2003, with IITA scientists working with colleagues from the US Department of Agriculture—Agricultural Research Service and national partners to collect more than 4,000 *A. flavus* strains from crops and soil. Through a laborious selection process, they selected four safe, competitive, and widely distributed atoxigenic strains native to Nigeria which serve as active ingredients of Aflasafe, the first registered natural aflatoxin biocontrol product for Africa, and just the third globally.

The work has shown results: treated fields contain significantly less aflatoxins—sometimes 100 percent less than nontreated crops. Moving the project forward to commercialization has involved registration, mandatory efficacy testing, safety evaluations, development of commercialization strategies, technology transfer, and infrastructure development. Though these steps are critical to getting the technology in the hands of farmers throughout the targeted countries, they have paradoxically delayed publishing of efficacy results in peer-reviewed scientific journals, which leads to ambiguous and sometimes negative perceptions about effectiveness, adoption, and sustainability of biocontrol in African contexts. In October 2019, the IITA-led team took a big step toward solving that problem with the publication in a landmark journal article of the longest-term study of any reporting on aflatoxin biocontrol products across the globe. The team reported on an extensive 10-year study that combined results of efficacy trials required for registration (2 years) with data from both large-scale trials to demonstrate product value (2 years), and commercial use by thousands of maize farmers (6 years). The data from commercial usage came from aflatoxin analyses on more than 213,000 tons of maize harvested in 15 states in Nigeria by over 90,000 farmers who applied Aflasafe to their crops. Their results showed that nearly 95 percent of more than 7,000 grain samples, each representing 30-ton grain lots, from treated fields had less than 10 parts per billion (ppb) of aflatoxins. The results establish Aflasafe as a stable, effective aflatoxin management tool within good agricultural management practices for crops grown by smallholder farmers and provide evidence of large-scale adoption of the biocontrol product in Nigeria.

The researchers are building on this experience as they work to demonstrate efficacy of biocontrol products in other countries, including for groundnut and maize in Senegal, chili pepper in Nigeria, and maize and groundnut in Ghana, looking across environments and diverse cropping systems over time. By the end of 2019, 12 Aflasafe products had been developed and registered for use in nine African nations, each containing four atoxigenic *A. flavus* active ingredients native to the target nation. Work continues to study efficacy in Ghana, Burkina Faso, Gambia, Mozambique, Malawi, Zambia, Kenya, Tanzania, Mali, and other countries where Aflasafe products are being tested.

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