

Notes from A-Maizing webinar on 12 January, 2021

The webinar, *AflaPak: An A-Maizing New Biocontrol Product for Corn in Pakistan*, was moderated by Deborah Hamilton with framing remarks by Babar Bajwa and presentations by subject matter experts, Pushpak Mehta, Ingredion, and Hillary Mehl, USDA ARS. More than 115 participants attended the webinar including the Pakistan Embassy Counselor, Qasim Mohiuddin.

The webinar was the final segment of a three-part series presented by the Feed the Future's interagency group, Food Safety Network, the U.S. government's Global Hunger and & Food Security Initiative. It highlighted the innovative public-private partnership established in Pakistan to advance aflatoxin biocontrol technology in maize production with the biocontrol product, AflaPak™. Speakers shared their experiences working with private industry, Rafhan Maize and Ingredion, and public partners, Pakistan's Department of Plant Protection and the Crop Disease Research Institute (CDRI) to update Pakistan's pesticide regulatory system and allow biopesticide registration in the country that is aligned with U.S. standards.

Agenda:

- Welcome and introductions, Deborah Hamilton
- Overview of Aflatoxin Issues in Pakistan and Long-term Solutions, Dr. Babar Bajwa
- Presentation, Dr. Pushpak Mehta
- Presentation, Dr. Hillary Mehl
- Moderated Discussion

Dr. Babar Bajwa presented on the behalf of CABI as its Senior Regional Director for Asia. He reviewed his professional career and provided a historical background of CABI, which was founded in 1910. CABI operates in 76 countries and has been involved in providing agricultural solutions to Pakistan since 1957. CABI and USDA have collaborated on 89 projects in Pakistan with the goals of:

- Promoting safer high-quality foods
- Improving agriculture production and export compliance
- Adoption of improved plant pest management technologies

One of CABI's main roles is to coordinate in-country activities and serve as USDA's implementing partner with the Pakistani National Plant Protection Organization (NPPO). Their contributions have helped to demonstrate the implementation and management of aflatoxin mitigation with their Pakistan partners, the Crop Disease and Research Institute (CDRI) and Rafhan Maize. CABI has also championed the adoption of biopesticide registration guidelines with Pakistan's NPPO, provided field aflatoxin mitigation workshops to farmers, and adopted a leading role in the Aflatoxin Mitigation Working Group.

Dr. Pushpak Mehta provided his and Ingredion's perspective on the development and implementation of the formulated aflatoxin mitigation product, AflaPak. (Also present for the webinar was Ulrich Nichtern, Ingredion management, and he praised Pushpak's contributions and guidance during the development and implementation of the biocontrol technology in Pakistan. He also cited the award of Ingredion's official recognition of Khalid Aziz during their Global Ag Forum for the work he has done to advance the development of AflaPak.)

Pushpak presented a history of Ingredion, which goes back to the founding of Corn Products Refining Company, in 1906. After numerous acquisitions over the years, the company adopted its current structure as Ingredion Incorporated with more than 11,000 employees. They “turn grains, fruits, vegetables into value added ingredients and biomaterial solutions for the food, beverage, brewing, and other industries”.

Their involvement with biocontrol of aflatoxin in Pakistani maize began in 2016 during their Global Ag Forum where Khalid Aziz presented the adoption of the biocontrol technology as a solution to the high aflatoxin levels associated with much of Pakistan’s maize crop. This followed Ingredion’s adoption in 2015 of sustainability goals that committed Ingredion to sustainably source 100% of all corn, tapioca, potato, peas and stevia crops. Ingredion approached the USDA ARS laboratory in Arizona and agreed to provide funding for the identification and development of an atoxigenic *Aspergillus flavus* strain native to Pakistan. During 2016 and 2017, Rafhan Maize collected maize samples and submitted those to the USDA ARS laboratory in order to identify potential atoxigenic strains of *Aspergillus flavus* associated with maize production. The ARS laboratory was able to identify an atoxigenic strain of *Aspergillus flavus* and developed a new formulation of a product, AflaPak, using this strain that could be trademarked. Field trials of AflaPak began in 2019 with 1,400 acres treated and samples collected by Pakistan’s Crop Disease Research Institute for evaluation. In this first year, reductions of 80% were achieved using AflaPak in the treated acres.

Pushpak noted:

- The carryover of the AflaPak strain to treated fields in subsequent years
- The importance of Ingredion’s/Rafhan Maize’s collaboration with USDA FAS
- The need to expand, to 20,000 acres in 2021, the treated acres and achieve the benefits of an area wide program.
- The importance of the Pakistani program as a precursor to Ingredion expanding the use of the technology to other countries, including China, Brazil and Mexico. Rafhan Maize in Pakistan was chosen to be the first test case of the technology by Ingredion because:
 - Rafhan Maize has a large presence in Pakistan with three manufacturing plants and approximately 200,000 acres under contract.
 - They have a large well- trained staff of scientists, agronomists and engineers
 - Rafhan Maize has excellent farmer relationships and multi-national corporations in Pakistan

Dr. Hillary Mehl, Research Plant Pathologist located at the U.S. Arid Agricultural Research Center, USDA, ARS, Arizona, began her presentation by defining the threat posed by aflatoxin in food supplies, which can contaminate food and feed crops, like corn, peanut, tree nuts, cottonseed and chilies. Health impacts of aflatoxins include cancer, stunting, reduced immune response and death. Aflatoxins can also restrict export opportunities due to health regulations that restrict the amount of aflatoxin permitted in imported foods.

The USDA ARS Aflatoxin Laboratory’s guiding objective is to optimize and expand the use of biocontrol based on the use of atoxigenic strains of *Aspergillus flavus* to improve access, affordability and area wide management of aflatoxins. This strategy was founded on the observation that different strains of *Aspergillus flavus* have different abilities to produce aflatoxins. To make the technology widely available, ARS has partnered with governments and research organizations, principally the International Institute of Tropical Agriculture in Africa, to register and promote Aflasafe, the formulated atoxigenic product, in 19 African countries.

The first patent for the aflatoxin mitigation technology in the U.S. occurred in 1989 and the first experimental use permit was issued in 1996. The atoxigenic product, AF36, has since received unrestricted use permits for cotton, pistachios, corn, almond and fig in the U.S.

USDA ARS began evaluation of Pakistan maize samples in 2017. The samples were evaluated for genetic characterization using simple sequence repeats (SSR) and cluster amplification pattern (CAP) analyses to identify atoxigenic strains. ARS strived to base their selection on optimal biocontrol characteristics including the most regionally effective according to wide distribution, laboratory assays and field trials. ARS further explored options for product formulation and product manufacture in cooperation with Ingredion.

A close collaboration has developed between the ARS Arizona laboratory and Pakistan's CDRI. A two-week Cochran training program was conducted at Virginia Tech's Tidewater Research Station while Hillary was employed there. Virtual training sessions have been held between Hillary and CDRI as well as consultations on appropriate methods of field trials and analyses of maize samples. Continued collaborative training for CDRI lab personnel is planned at IITA's research facility in Nigeria after the treat posed by COVID-19 has passed.

Both Hillary and Pushpak stressed the significance of the carry over effect of atoxigenic *Aspergillus flavus* treatments to adjacent fields and subsequent seasons to the area wide management of aflatoxin producing strains.

Questions and comments:

- Is AflaPak approved for use in Pakistan? – An application has been submitted to the Pakistan NPPO along with a guidance document for approval of biocontrol agents. It is believed that AflaPak will be approved in 2021. Additional field trials will be needed to have AflaPak approved for use with other crops, like chilies.
- Will the use of AflaPak transition to other crops? – CDRI and CABI, along with USDA, are focused on developing a biocontrol product for chili and hope to find the AflaPak strain associated with chili production. If the AflaPak strain is found with chili crops, then the registration can be expanded to include chili as was done with AF36 in the U.S.
- A transition from maize to chili is underway. CDRI has collected samples from chili fields and is in the process of analyzing those samples. The USDA ARS laboratory is assisting in this evaluation of chili samples and will be screening the samples for the presence of the AflaPak genotype. Building on the work with chili, the team would like to eventually screen cotton and peanut for atoxigenic *Aspergillus flavus*.
- Chris Butts at the Georgia ARS laboratory mentioned that the AflaGuard formulation consisted of two strains that did not poses the genetic precursors for aflatoxin and asked if Hillary's lab was looking for similar strains without the precursors in Pakistan chili samples. Hillary responded that they were conducting CAP and SSR analyses to identify *Aspergillus flavus* strains that could not produce aflatoxins.
- The speakers were asked how the private/public partnerships works. – Babar responded that first what was needed was the technical and research capacity to carry out the objectives. Secondly, there needed to be a demand from the private sector along with financial investment from the public agencies. Hillary added that the goal was to expand biocontrol to food safety systems throughout the world, which required access to growers and manufacturing facilities together with appropriate technology transfer.
- Deborah asked the speakers to highlight the challenges and rewards they have experienced in the development of AflaPak.

- Hillary mentioned that bringing together the appropriate individuals and agencies to coordinate and act on the working goals presented the biggest challenge.
- Babar agreed that coordinating diverse teams with private sector needs and timelines together with obtaining government approvals was a challenge in reaching the ultimate objective of improving food safety.
- Pushpak stressed the synergy of the private sector working with the public sector towards a common goal and added that if you reach for the stars you can get star dust.