



FEED THE FUTURE

The U.S. Government's Global Hunger & Food Security Initiative

Welcome! We are delighted you could join us. A few reminders for today's webinar.

- Please **mute** your microphone and **turn off** your video.
- We encourage you to introduce yourself and mention where you're tuning in from in the chat box.
- Please enter all questions into the chat. We will collect these to address in the discussion session at the end.
- The webinar is being recorded and will be made available after the webinar.

Thank you





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The Food Safety Network

Bringing the best of Food Safety Practices to the World

Participating Agency Program Agreement (PAPA)

Online library of
best practices

Rapid needs
assessments for
USAID Missions

Coordinated U.S.
government
expertise

Links to animal
and plant health
and food safety

Online interactive
sanitary and
phytosanitary
training

Agrilinks.org/activities/food-safety-network

October 1, 2016 to September 30, 2021



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AflaPak: An A-Maizing New Product for Corn in Pakistan

January 12th, 2021



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OUR SPEAKERS



Dr. Babar E Bajwa
Senior Regional Director
CABI



Dr. Pushpak Metha
Corn Breeder
Ingredion



Dr. Hillary Mehl
Lead Scientist
USDA - Agricultural
Research Service



Deborah Hamilton
Program Manager
USDA - Foreign Agricultural
Service



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Speaker **BABAR E BAJWA (PhD)**

USDA Cochran Fellow, ACIAR John Dillon Fellow, IVLP State Alumni

b.bajwa@cabi.org



**DR BABAR
E BAJWA**



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Brief Bio



EXPERTISE

I work as **Senior Regional Director** for CAB International. I collaborate and build partnerships with member country Governments, which lead to the delivery of our organizational mission, "Improving peoples lives, by applying scientific expertise to solve problems in agriculture and the environment". I build partnerships with member countries, scientific research organizations, agricultural development organizations and development cooperation agencies including developmental banks. My objective is to serve the member Governments to enhance cooperation and build better, sustainable food systems.



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EDUCATION



SPOCE Project Management Ltd. U.K.
Certification: **PRINCE-II**
Field Of Study Project Management
2014 – 2014



Melbourne Business School
Certification: **New Managers Development Programme**
2009 – 2009



University of Agriculture, Faisalabad
Degree: **Ph. D. Food Technology**
2002 – 2007



University of Agriculture, Faisalabad
Degree: **M. Sc. (Hons.), Food Technology**
1998 – 2001



Arid Agriculture University, Rawalpindi
Degree: **B. Sc. (Hons.) Agriculture**
(Major: Food Technology)
1994 – 1998



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HONORS & AWARDS



USDA Cochran Fellow 2017

Honor Date: Jul 2017 | Description: The Cochran fellowship award is given to distinguished professionals around the world who contribute to the development of agriculture sector.



International Visitor Leadership Program
U.S. Department of State

International Visitors Leadership Programme (Farm to Table)

Honor Date: 2012 | Honor Issuer: United States Department of State, USA



Sir John Dillon Fellowship-Asia Pacific Outstanding Agriculture Researcher Award

Honor Date: 2009 | Honor Issuer: ACIAR, Department of Agriculture Fisheries and Forestry, Australia





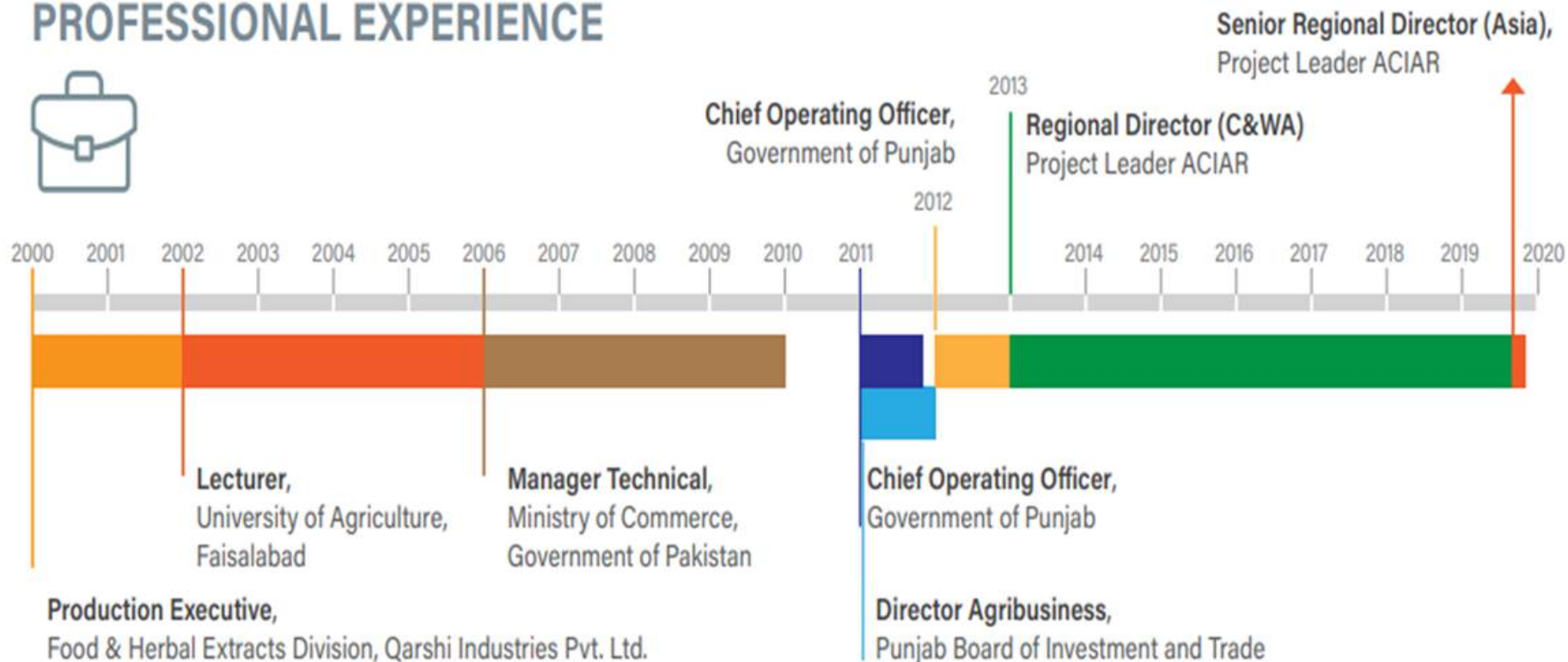
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PROFESSIONAL EXPERIENCE



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Centre for Agriculture & Bioscience International (CABI)



A historical institution since 1910

CABI operates across 76 countries as an international inter-governmental agency with a United Nations treaty.

Government of Pakistan is one of the senior members of CABI since 1957.



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1910-1930

1910

CABI started with a small grant to fight the devastating impact of insects, pests and diseases on man, animals and crops.

1913

Sir Guy Marshall (1871-1959), founder of CABI, with Mr Nazir Ahmad Aslam, a student from Pakistan



1930-1948

1930

The Imperial Agricultural Bureaux is officially formed as a Commonwealth organization.

1947

Imperial Agricultural Bureaux becomes the Commonwealth Agricultural Bureaux (CAB).



Fleming's strain of Penicillin Notatum held in CABI's culture collection



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1948-2017



2018-2020



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Research Cooperation Since Inception



Total 149 studies and cooperation projects implemented till date (113 research and technology projects & 36 development projects).

90% of the work is with Government.



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Cooperation with Government of Pakistan



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Our Partners/Collaborators

1 - MINISTRY OF NATIONAL FOOD SECURITY AND RESEARCH

- Pakistan Agricultural Research Council
- National Agriculture Research Centre
- Department of Plant Protection

2 - DEPARTMENT OF AGRICULTURE PUNJAB

- Department of Agri. Extension
- Department of Agri. Research
- Department of Plant Protection
- University of Agriculture, Faisalabad
- Arid Agriculture University Rawalpindi

3 - PUNJAB RURAL SUPPORT PROGRAMME

4 - DEPARTMENT OF AGRICULTURE & LIVESTOCK KHYBER PAKHTUNKHWA

- Department of Agri. Extension
- Department of Agri. Research
- Department of Livestock Extension

5 - MINISTRY OF PLANNING, DEVELOPMENT & SPECIAL INITIATIVES

6 - DEPARTMENT OF AGRICULTURE SINDH

- Department of Agri. Extension
- Department of Agri. Research
- Sindh Agri. University Tandojam

7 - DEPARTMENT OF AGRICULTURE BALOCHISTAN

- Department of Agri. Extension
- Department of Agri. Research



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Collaborative work in Pakistan



1. Aflatoxin Control in Pakistan
2. SPS Compliance in Afghanistan
3. Better Cotton Initiative (BCI)
4. Plantwise Pakistan & Afghanistan
5. Cotton Advocacy for Policy and Seed (CAPAS)
6. Strengthening Vegetable Value Chain in Pakistan (SVVCP)
7. Natural Enemies Field Reservoirs (NEFRs) in Pakistan
8. Action on Invasive (AOI)
9. Introduction of Certification Facilities for Agriculture Interventions in KP
10. Enhancing Technology Based Agriculture and Marketing in Punjab
11. Cluster Development Based Agricultural Transformation Plan 2025 (CDBAT)
12. Regulatory Harmonization in Pakistan for MRLs and Biopesticides



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Rafhan Maize
PRODUCTS CO LTD

USDA



CABI



Aflatoxin Control In Pakistan



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USDA



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Contribution to Pakistan's Agricultural system



Promote safer,
higher quality and
locally produced
food through
knowledge based
advice

Promote agricultural
production &
exports through
compliance

Adoption of
improved pest
management
technologies and
farmers
participation




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Coordination with NPPO

- 
- Demonstration of the field response of biocontrol product (AflaPak) for management of aflatoxins in Pakistan.
 - Guidelines for “registration of biopesticides in Pakistan”.
 - Aflatoxin testing facility in Pakistan.





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Project Working Group



Deborah Hamilton, Senior International Program Manager FAS; Eric Brownstein, FAS, Asmat Raza, Senior Agricultural Specialist FAS.



Dr. Mubashra Mukadas, Pakistan post.



Dr. Babar Bajwa, Project Executive; Dr. Sabyan Faris Honey, Project Manager; Dr. Hamzah Shahbaz, Program Officer; Dr. Muzammil Farooq, Project Officer; Mr. Saqib Ali, Communication Assistant.



Dr. Muhammad Khalid Aziz, Senior Manager Agribusiness; Mr. Muhammad Shafique, Deputy Manager Agribusiness Development.



Dr. Shehzad Asad, Director Crop Disease Research Institute - CDRI; Dr. Atif Jamal, Senior Scientific Officer CDRI



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AflaPak: An A-Maizing New Biocontrol Product for Corn in Pakistan



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Ingredion.

**Ingredient
Solutions That
Make Life
Better**

An overview of
Ingredion Incorporated



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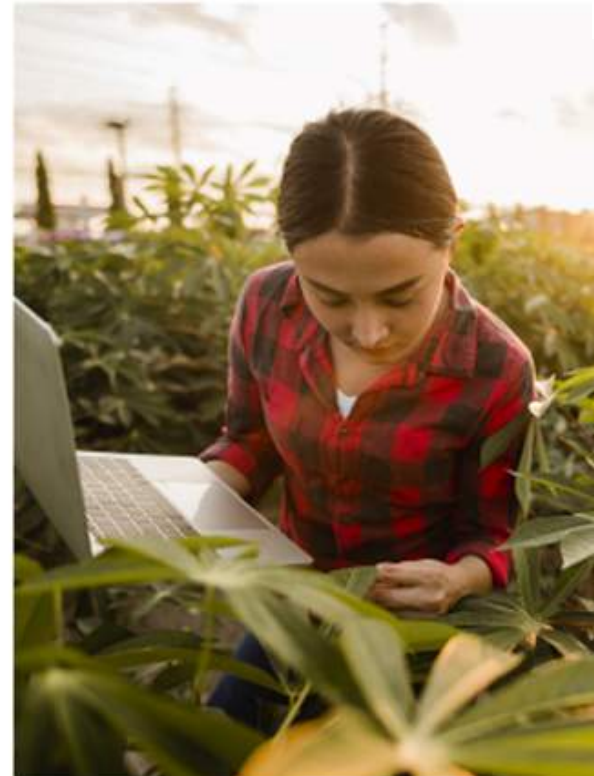


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Global reach and local touch

- **Ingredion** is a global ingredient solutions company built on a rich legacy of **exceptional performance** and **market-leading innovation**. Our geographic footprint and diverse workforce give us the ability to deliver solutions on a **global scale** and with the agility to meet the needs of **local markets**.
- We make it our business to understand industry trends and our customers' challenges. They trust us to anticipate and deliver consistently **high-quality products** and **innovative solutions** they need.



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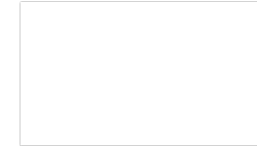




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We are Ingredion



We turn grains, fruits, vegetables and other plant-based materials into value-added ingredients and biomaterial solutions for the food, beverage, brewing and other industries.

18,000

CUSTOMERS IN MORE THAN
120 COUNTRIES



A GLOBAL NETWORK OF
INNOVATION CENTERS,
MANUFACTURING FACILITIES
AND SALES OFFICES IN MORE
THAN **40 COUNTRIES**

11,000+

TALENTED AND ENGAGED
EMPLOYEES

\$6.2
billion

NET SALES IN 2019

INGR
LISTED
NYSE

A FORTUNE

500

COMPANY



HEADQUARTERED
OUTSIDE CHICAGO, IL

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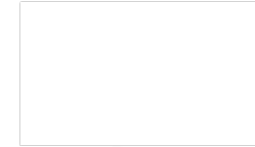
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Our Purpose



*We bring the potential of people, nature, and technology together
to create ingredient solutions that **make life better.***



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Our values guide us in all that we do



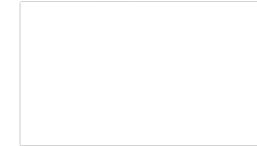
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Operational excellence



SAFETY LEADERSHIP

- World-class levels
- Comprehensive strategy, strong management commitment and employee engagement



COMMITMENT TO QUALITY

- 83% of facilities ISO:9001 certified*
- 100% of facilities have achieved Global Food Safety certification



WORLD-CLASS MANUFACTURING AND GLOBAL SUPPLY CHAIN MANAGEMENT

- Focus on network optimization and operational excellence



CULTURE OF CONTINUOUS IMPROVEMENT

- Using Lean Six Sigma methodologies to improve performance



CUSTOMER-FOCUSED

- Local supplier with extensive manufacturing network
- Business and technical teams to serve regional and local markets



CONTINUED FOCUS ON SUSTAINABILITY

- Commitment to further our efforts in environmental conservation
- Promoting responsible and ethical business practices across our supply chain



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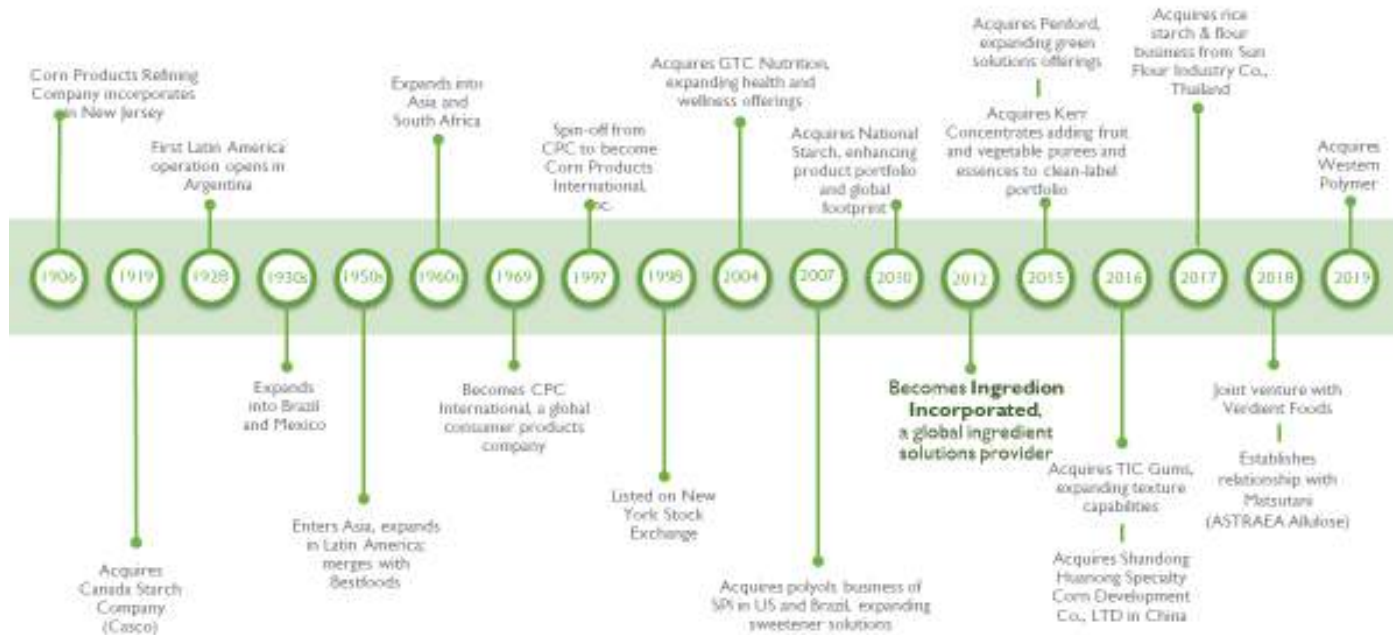
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A rich legacy of innovation and growth



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More than 1,000 ingredient solutions

NATURE-BASED RAW MATERIALS

Corn

• Tapioca

• Potato

• Stevia

• Rice

• Pulses

• Others

Starches

- Corn
- Rice
- Tapioca
- Waxy corn
- Potato
- Flours
- Functional native starches
- Modified starches
- Resistant starches
- Pre-gel
- Dextrin
- Gluten-free
- Blends
- Others



Fruit & Vegetable Products

- Fruit juice concentrates
- Vegetable juice concentrates
- Purees and puree concentrates
- Essences
- Distillates
- Pomace
- Whole, sliced, diced strawberries

Sweeteners

- Stevia
- Glucose syrups
- Glucose solids
- HFCS
- Maltose syrups
- Maltodextrins
- Dextrose
- Polyols
- Non-GMO syrups
- Fructooligosaccharide
- Galactooligosaccharide
- Isomaltooligosaccharide
- Caramel color
- Fermentation products
- Blends
- Allulose



Other

- Pulse proteins
- Corn gluten feed
- Corn gluten meal
- Crude corn oil
- Refined corn oil
- Hydrocolloids
- Tapioca fiber
- Prebiotic soluble fiber
- Biopolymers
- Plant-based proteins
- Others



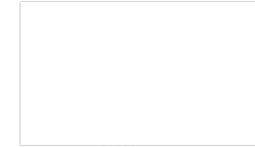
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Sweeteners, starches and nutritional ingredients net sales



53% food



11% beverages



10% animal nutrition



7% brewing



19% additional applications

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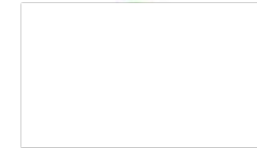




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Global customer reach



DRIVINGGROWTH

Company headquarters Production facility Ingredion-USA LBDP seed partner Ingredion-USA LBDP innovation center Sales representative office



NET SALES: \$3,511 M, 60% of Ingredion

CUSTOMERS: 39% of Ingredion

POPULATION: 493 m, 7% of World



NET SALES: \$943 M, 16% of Ingredion

CUSTOMERS: 21% of Ingredion

POPULATION: 424 M, 6% of world



NET SALES: \$584 M, 10% of Ingredion

CUSTOMERS: 15% of Ingredion

POPULATION: 2.2 B, 30% of world



NET SALES: \$803 M, 14% of Ingredion

CUSTOMERS: 25% of Ingredion

POPULATION: 4.3 B, 57% of world



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EMEA presence and large specialty business

- \$592 million net sales, 10% of total sales
- European business predominantly specialties; a leader in Clean Label solutions for both CPG and retail ready meals
- Strong presence in Pakistan with solid core growth, building specialties platform
- Growing specialties business in emerging markets in Middle East, Eastern Europe and Africa



NET SALES: \$592M, 10% of Ingredion

CUSTOMERS: 15% of Ingredion

POPULATION: 2.2 B, 30% of world



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Our sustainability program

- The **Company of Choice for a Sustainable Tomorrow** plan
- Launched in 2015 and outlines our efforts through 2020
- Designed with employees, customers, communities and shareholders in mind
- Sustainably sourced 2.8 million metric tons of crops globally
- Established sustainability goals and by 2025 we will sustainably source 100% of all corn, tapioca, potato, peas and stevia crops



Ingredion



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Aflatoxins: potent natural carcinogen



Ingredion

BBC NEWS UK EDITION
Last Updated: Sunday, 14 March, 2004, 17:48 GMT
E-mail this to a friend | Printable version

'Cancer risk' brazil nuts seized
Sixty tonnes of Brazil nuts, believed to contain causing chemicals, have been seized and destroyed by health officials.

Three containers were seized by health officers at Southampton when they arrived on a freighter from Brazil.

The city's port health officials say the nuts had been stored more than 56 times the legal limit.

Health officials obtained samples for testing.

Imported brazil nuts are popular in the UK according to European cancer of the liver.

Aflatoxins are formed by fungi on nuts and nut products.

When the test results came back, the UK's food inspectors were informed but refused to accept the findings.

Poison paprika
The Hungarian government has ordered the stocks of three paprika brands to be destroyed after a report that they contained a potent carcinogen.

THE DAILY STAR
Copyright (c) 2003 The Daily Star
Friday, February 04, 2005
EU increases safety regulations on Iranian pistachios

Hungry Hungary in spice crisis
Agencies in Budapest
Saturday October 30, 2004
The Guardian

...nuts from Iran, the world's top exporters.

...aflatoxins from Iran constitute a 'selective measure'.

...the Islamic Republic's top non-oil risk of liver cancer even at very low levels.

...if all consignments going into the UK are of production, handling and storage standards.

...aflatoxin moulds forming during storage.

...around 240,000 tons a year.

...a high incidence of aflatoxin in the country.

...procedure to check all consignments.

...ing vegetation, and determining the chemical composition.

...her than such as aflatoxin.

CDC
MMWR
Weekly
September 2, 2004 / 53(15) / 1-10

Outbreak of Aflatoxin Poisoning --- Eastern and Central Provinces, Kenya, January--July 2004

In May 2004, CDC Kenya, members of the CDC-supported Field Epidemiology and Laboratory Training Program (FELTP) in Kenya, the World Health Organization, and CDC were invited by the Kenya Ministry of Health (KMOH) to participate in the investigation of an outbreak of acute liver failure (ALF) in the districts of Malindi and Kilifi, Eastern Province. Preliminary laboratory testing of food collected from the affected area revealed high levels of aflatoxin, suggesting that the outbreak was caused by aflatoxin poisoning, a well-known natural toxin in the world's food supply. The 2004 outbreak resulted from widespread aflatoxin contamination of locally grown maize, which occurred during storage of the maize under damp conditions. Uptake replacement of the aflatoxin-contaminated maize with noncontaminated maize proved to be a critical intervention; however, as of July 21, a limited number of acute cases continued to be diagnosed. This report summarizes the preliminary results of the outbreak investigation. Aflatoxin poisoning likely will continue to be a public health problem and culturally appropriate storage methods for dry maize are emphasized for the local population. In addition, enhanced surveillance for human aflatoxin poisoning and testing of commercially available maize for aflatoxin are recommended.

BBC NEWS WORLD EDITION
Last Updated: Sunday, 13 June, 2004, 12:33 GMT 13:33 UK
E-mail this to a friend | Printable version

Killer maize sparks Kenya alarm
Several Kenyan politicians have urged the government to declare a national emergency over the deaths of 28 dogs.

Twenty-eight bags of maize were found to be contaminated with aflatoxin.

Tainted dog food maker to pay for pet deaths
Diamond Pet Food agrees to \$2.1 million settlement with owners.

...Contamination of Agricultural Commodities by the Food and Agriculture Organization (FAO).

...and severe health and economic problems in Africa.

...any parts of the world, especially in developing countries where they are more likely to be contaminated with aflatoxin.

...one of the reasons for the high rates of infant mortality.

FDA issues pet food alert after 28 dogs are reported dead from toxin

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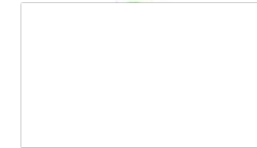




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Aflatoxin Biocontrol at Ingredion



- 2016 – Global Ag Forum
- Pakistan was chosen as the first country
- Ingredion-USDA agreement to develop biocontrol product for Rafhan
- Extensive sampling, funding USDA, personnel training
- Improved product formulation to fit Ingredion plants across the world
- Field implementation – 1400 acres in 2019
- >80% toxin reduction

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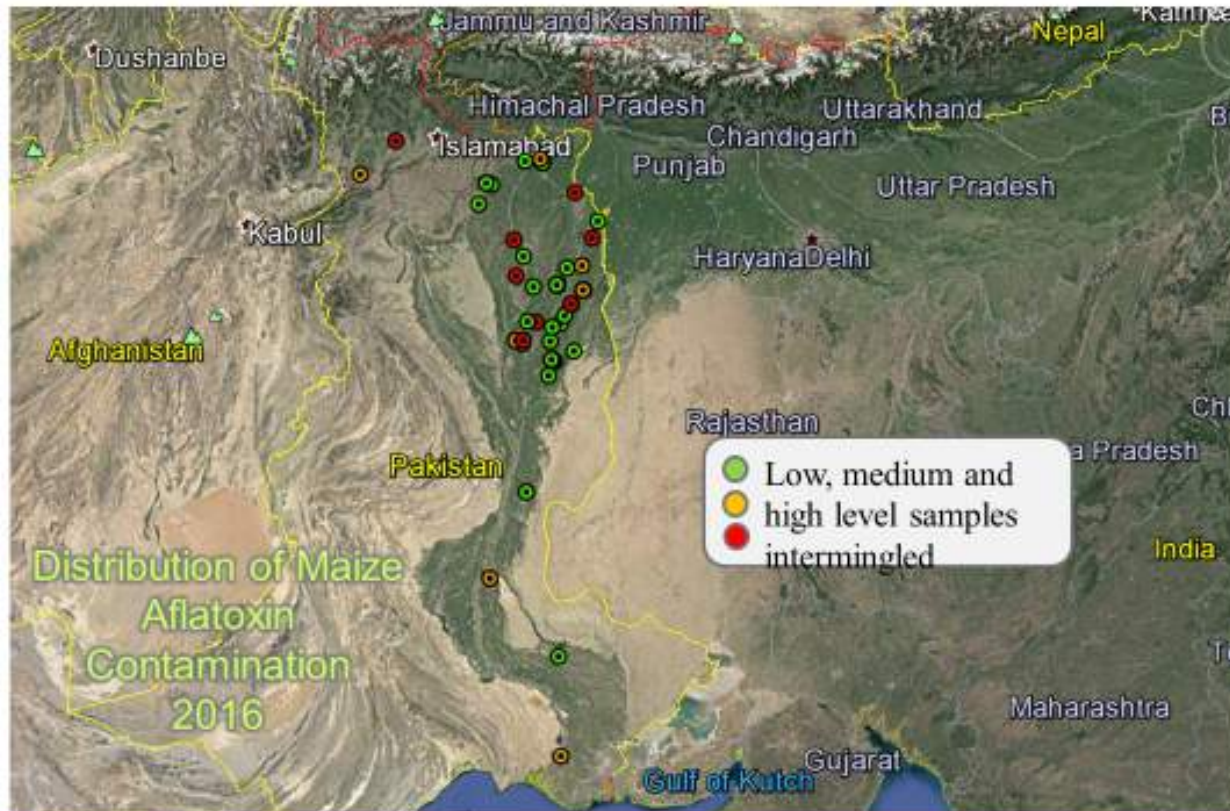
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Distribution of Maize Aflatoxin Contamination Pakistan



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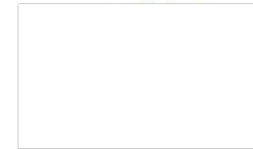




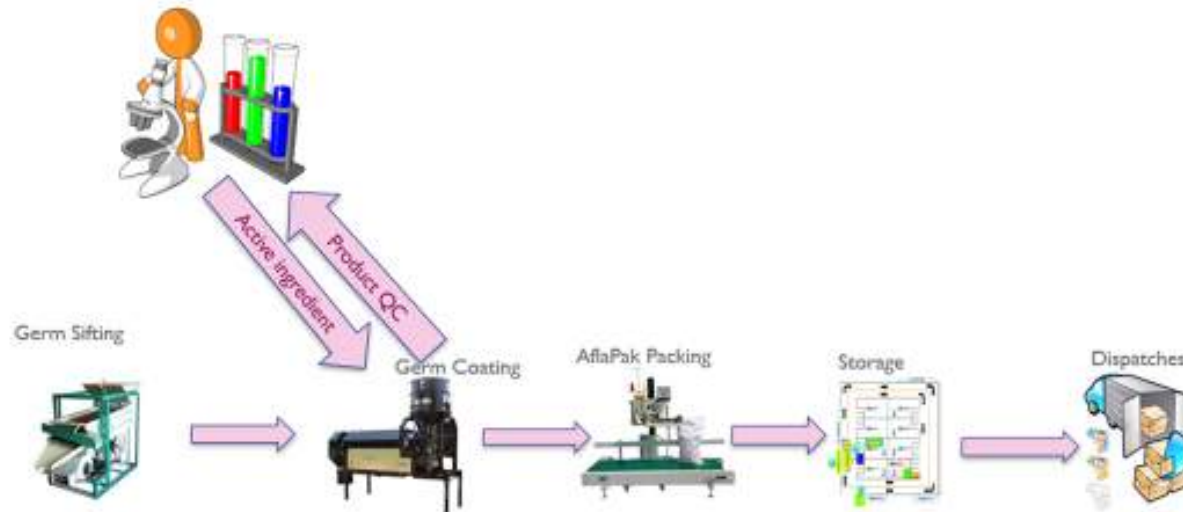
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Key steps



AFLAPAK PROCESS FLOW



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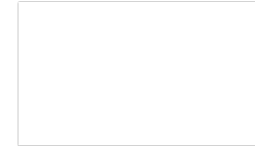
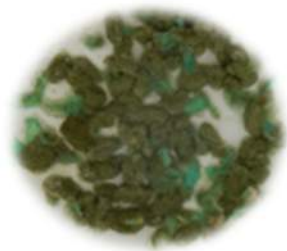




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AflaPak Manufacturing and Application



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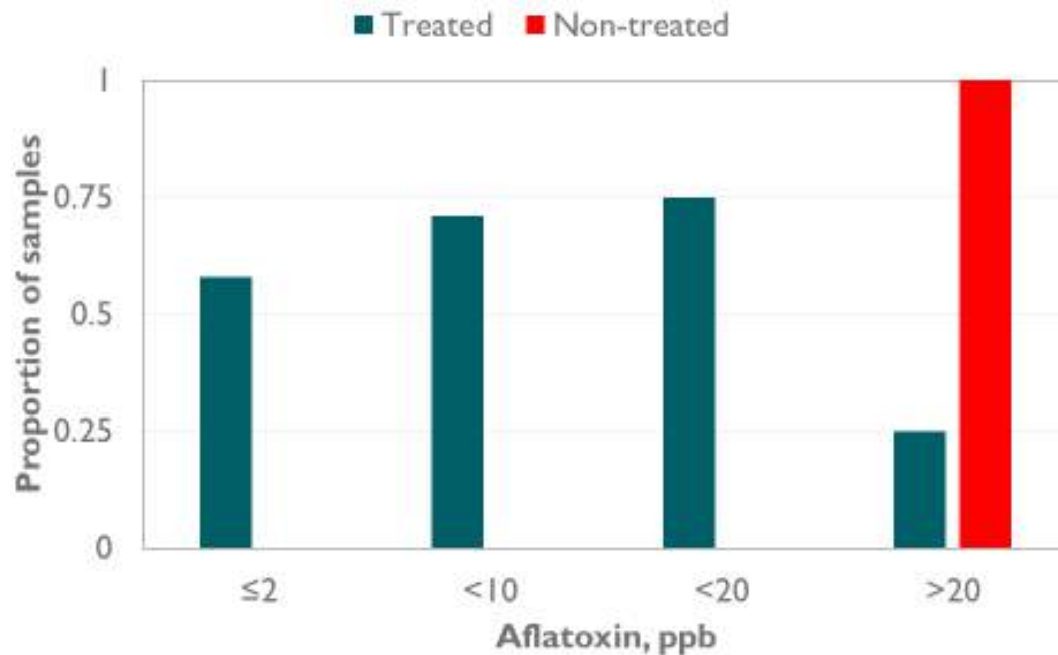
Aflatoxin, ppb

Average AflaPak treated fields: 18 ppb

Average non-treated fields: 145 ppb



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75% of the AflaPak treated fields <20 ppb aflatoxin.
58% of the treated fields, aflatoxin was 2 ppb or less.

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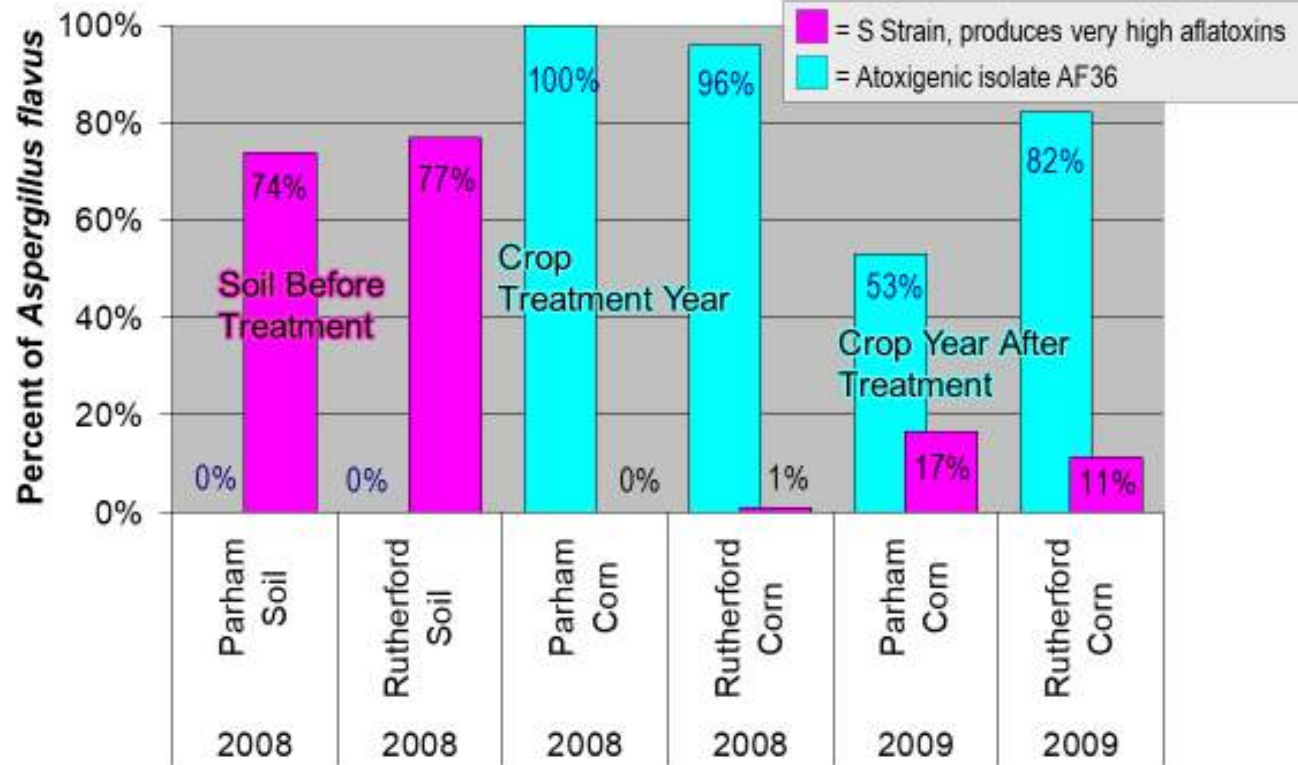
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Carry Over to the Second Year Crop



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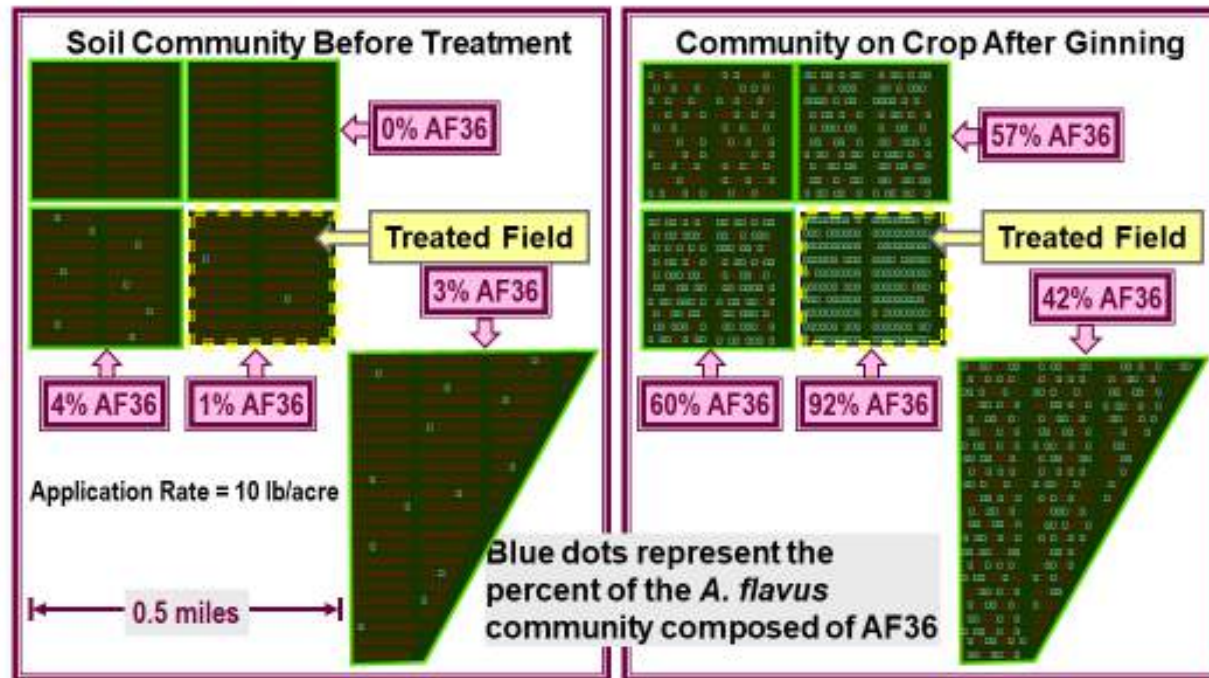
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Atoxigenic Strain Influences Fields Treated and Nearby Fields



Data from 564 vegetative compatibility analyses.

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Project update

- 5000 acres in 2020, >20,000 acres in 2021
- Mapping, Manufacturing, Timely distribution, Application, Sampling, Analyses
- Personnel hiring, Training, Manufacturing facility, Lab
- Regulatory approval for commercialization
- Business model
 - Product cost
 - Rafhan corn: contract acres, non-contracted farmers
- **CEO Sustainability Award**



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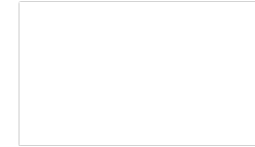


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Why Rafhan?

- Long history working with corn and farmers
- 3 Manf. plants; >500K ton corn; 200,000 acres; ~15,000 aflatoxin tests annually
- Team of Agronomists, Engineers, Scientists
- Farmer relationships spanning generations
- Largest single buyer...
- Export opportunities
- Part of a global company – will help replicate in other INGR countries
- Ingredion model: **We are the market...**
 - Contracted acres: Preference to farmers who have treated all corn
 - Relationship with farmers and consumer facing MNCs with sustainability goals



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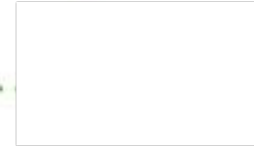




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Partnering Opportunities to Create Synergy...



- Ingredion is making an investment...
- FTO
- Focus on Results - timely commercialization
- What can Public/ Govt. do to help Rafhan, and thus the project, succeed?
 - USDA-FAS support working with the local Govt.
 - Creating new market – partnering with industries
 - Area-wide program: Purchase product from Rafhan for widening the area and applications on other crops
 - Incentive to farmers for applying
- Climate change will only exacerbate mycotoxin problem
- Depending upon Pakistan results - China, Brazil, Mexico
- ...benefits of which could be reaped by all of Pakistan and beyond!
- We have a life-time opportunity... to make a difference, together!!



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Prevent Formation of Dangerous Aflatoxin Levels

Protect Crops From Field...



During Storage



...to Mouth



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Bio-control is area-wide management. Fungi move across fields reducing aflatoxins throughout area.



Bigger view: Not just one field, one farmer, one crop.
Particularly important for industrial manufacturing
sourcing corn from fields in close proximity.
A Sustainable Solution...

We can protect whole agricultural systems from aflatoxins including all affected industries. And improve the environment.

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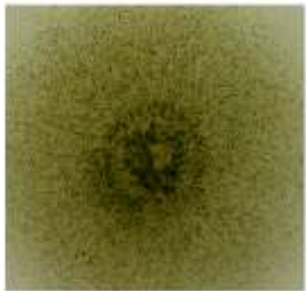
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AflaPak: USDA-ARS Contributions to Development of a New Aflatoxin Biocontrol Product for Pakistan

Dr. Hillary L. Mehl

Research Plant Pathologist

USDA Agricultural Research Service

January 12, 2021



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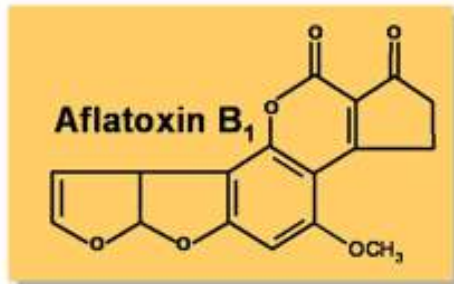


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Aflatoxin contamination of crops

- Aflatoxins are highly toxic (in ppb), carcinogenic metabolites produced by *Aspergillus flavus*
- Contaminate food and feed crops – corn, peanuts, tree nuts, cottonseed, chilies, etc.
- Health effects: cancer, stunting, immune suppression, death
- Regulations = economic impact, barriers to trade



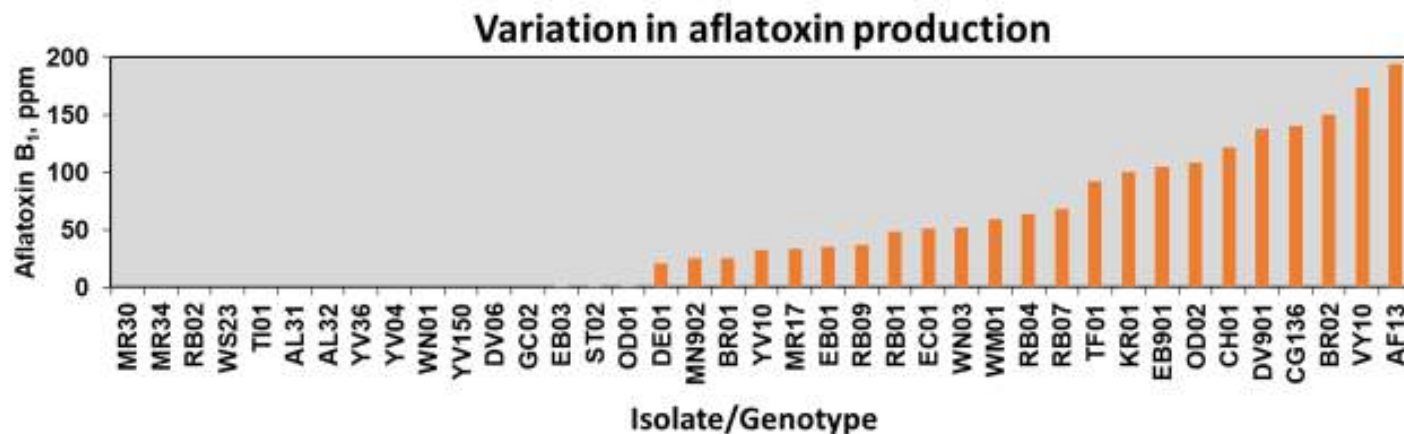
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Aflatoxin biocontrol

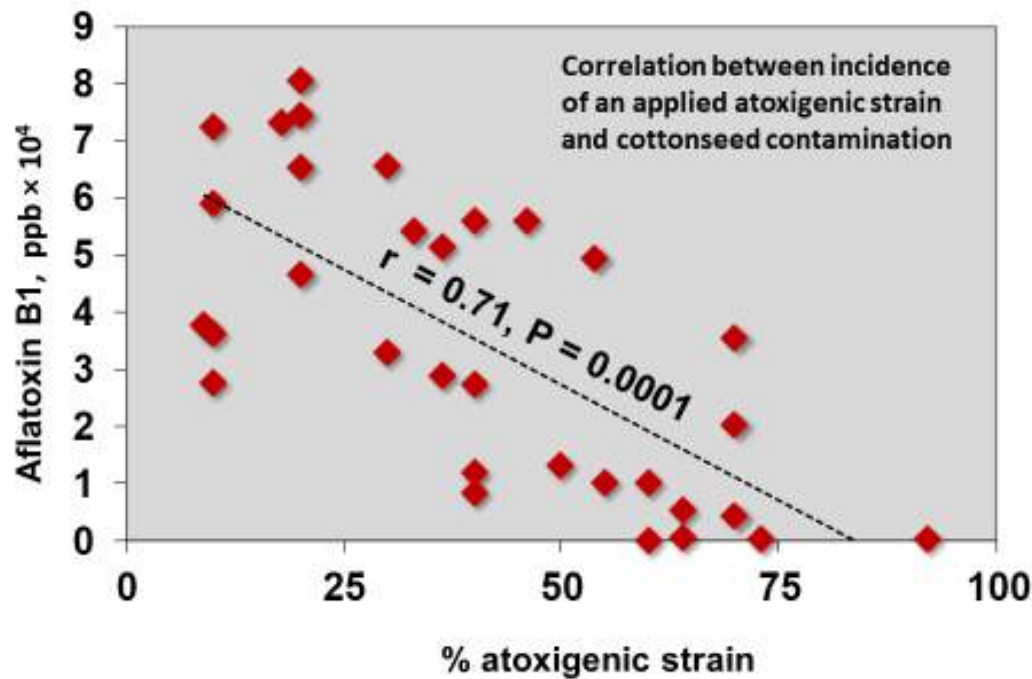
- *Aspergillus flavus* isolates vary in ability to produce aflatoxins
- **Atoxigenic** (do not produce aflatoxins) isolates common in environment
- Aflatoxin contamination influenced by the average aflatoxin-producing potential of crop-associated fungi





Competitive displacement of aflatoxin-producers

>90% displacement and reduction in aflatoxin common



Cotty 1994, *Phytopathology*



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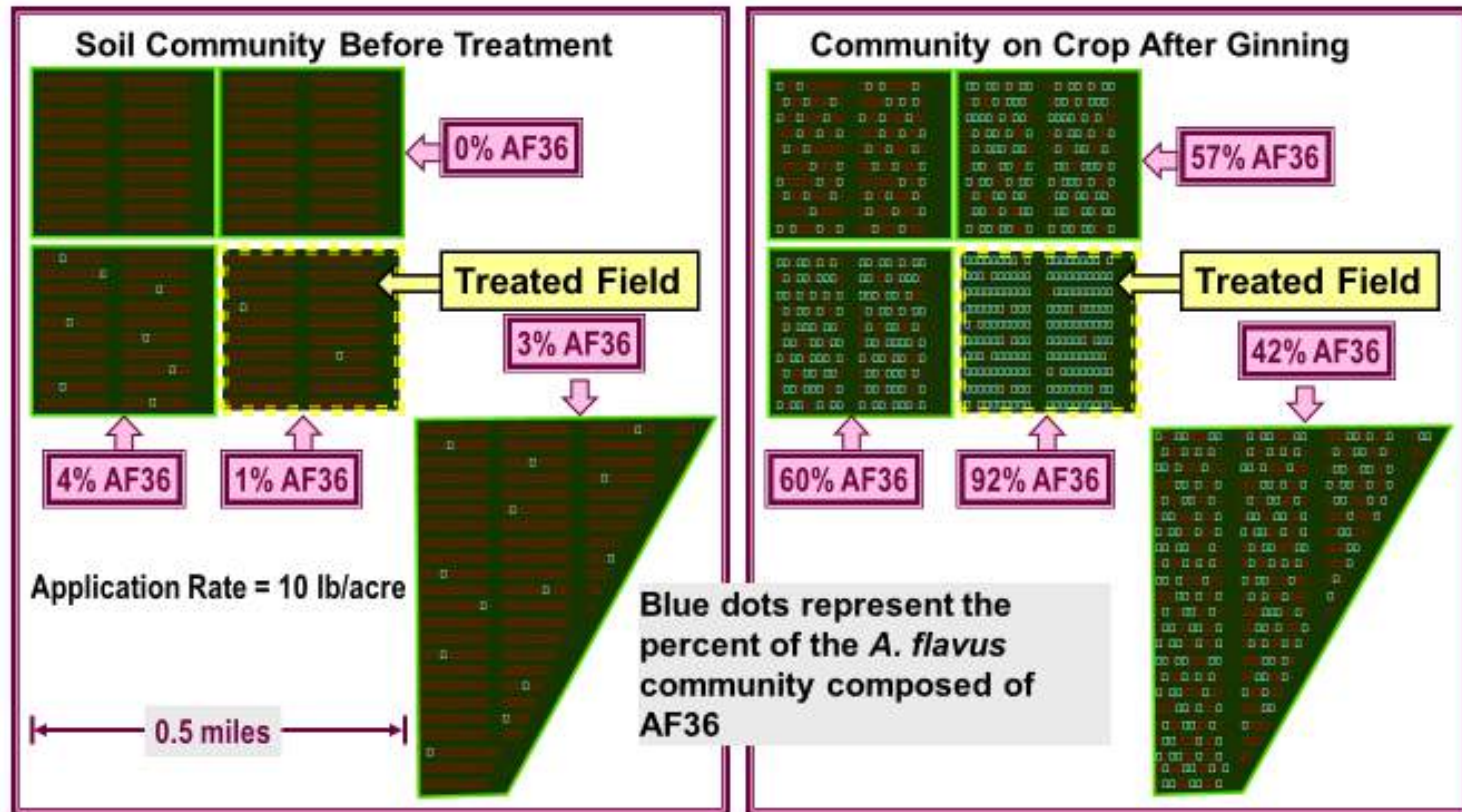




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Application of atoxigenic strain AF36 in commercial cotton influences composition of fungi on treated and nearby fields



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Timeline for development of first aflatoxin biocontrol product (AF36)

- 1989:** First Patent Application (Dr. Peter Cotty, USDA-ARS)
- 1993:** Preregistration meeting with EPA on atoxigenic strain potential
- 1995:** IR-4 Biopesticide Program joined registration effort
- 1996:** First Experimental Use Permit (EUP) for cotton (1120 acres)
- 1998:** Arizona Cotton Research and Protection Council (ACRPC) initiates first atoxigenic manufacturing facility
- 1999:** EUP expanded to 22,000 acres/year
- 2003:** Unrestricted registration allows unlimited cotton treatments
- 2007:** EUP to Treat 3,000 acres of pistachios
- 2008:** EUP to treat 6,000 acres of corn
- 2011:** Unrestricted registration for corn
- 2012:** Unrestricted registration for pistachio.
- 2016:** Unrestricted registration for AF36 Prevail (new formulation)
- 2017:** Unrestricted registration for almond and fig



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USDA-ARS Aflatoxin Biocontrol Lab

- Optimize and expand use of biological control of aflatoxins based on atoxigenic strains of *Aspergillus flavus* in order to improve access, affordability, and area-wide management.



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Selection of optimal biocontrol strains for aflatoxin mitigation in target regions

- Identification of atoxigenic genotypes associated with crop
- Selection of most effective, regionally adapted strains
 - Distributions of genotypes
 - Lab assays
 - Field trials



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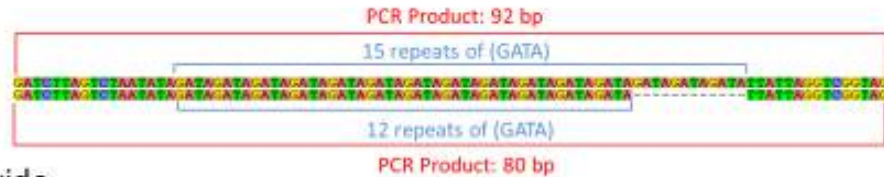
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Identification of candidate atoxigenic biocontrol active ingredients

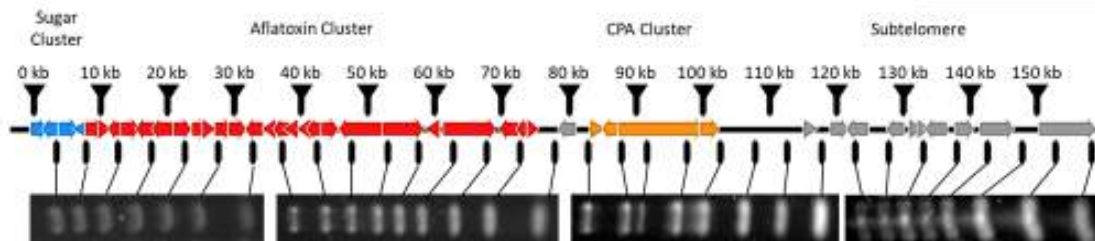
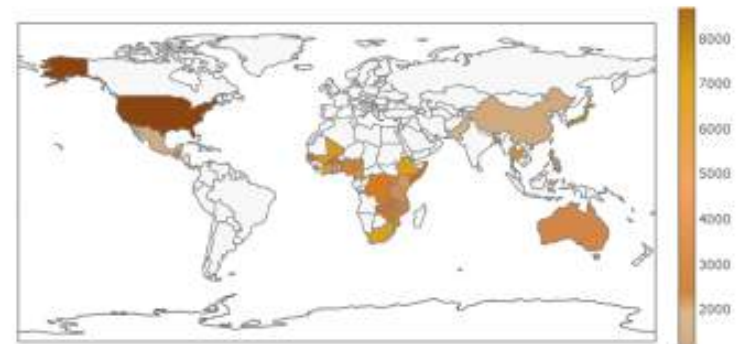
- Simple sequence repeats (SSRs)

- Genotyped using 17 SSR markers
- 20,000 isolates from 36 countries
- >13,000 unique haplotypes identified worldwide



- Cluster Amplification Pattern (CAP) analysis

- 32 markers amplified in 4 panels
- 13 markers in aflatoxin cluster
- 4 markers in CPA cluster
- Identifies deletions in aflatoxin cluster (atoxicogenic)



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Aflatoxin biocontrol is needed worldwide



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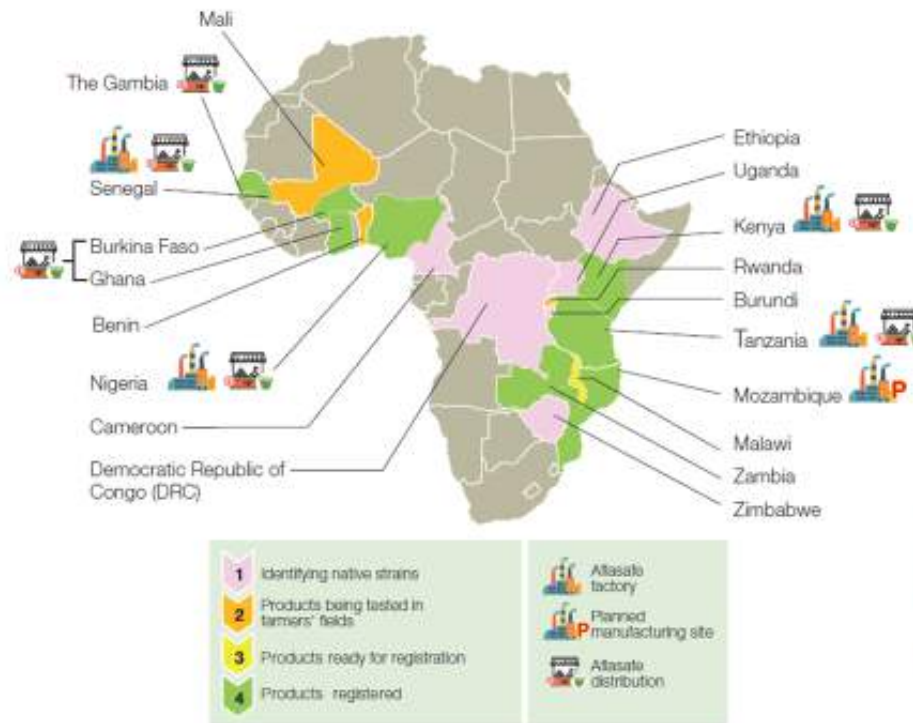




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Aflasafe: Expansion of aflatoxin biocontrol across Africa



IITA
Transforming African Agriculture



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AflaPak: Aflatoxin biocontrol for Pakistan



A public-private partnership program led by U.S. company, Ingredion and its Pakistani subsidiary, Rafhan Maize.



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AflaPak research and development

- Genetic characterization and selection of candidate biocontrol strain (USDA lab, 2017-2018)
- Product formulation and manufacturing
- Efficacy trials in commercial maize fields (2019-2020)



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Multiple U.S. and international partners



Pakistan Crop
Disease Research
Insitute (CDRI)



Centre for Agriculture and
Bioscience International



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Cochran Fellowship Training – Virginia Tech



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Registration of AflaPak

- Establishment of biopesticide registration process in Pakistan (IR-4)
- Preparation of registration application
 - Biocontrol active ingredient strain identity
 - Argument for safety of active ingredient
 - Efficacy data
 - Manufacturing process
 - Quality control
- Submitted to Pakistan Department of Plant Protection (Summer 2020)



Pakistan Crop
Disease Research
Institute (CDRI)



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Thank You!

The recording for today's presentation will be made available at
<https://www.agrilinks.org/events/aflapak-maizing-new-product-corn-pakistan>

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