di *Aspergillus flavus* e festione della filiera, un future per maiscoltura e "latte italiano di qualità"
9 febbraio, 2017. Università Cattolicà del Sacro Cuore, Piacenza

Biocontrollo *Aspergillus flavus*, l'origine e la storia americana

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TECHNOLOGY

Food-Safety Strategy Pits Germ vs. Germ

By Scott Kilman

Staff Reporter

As food p... tists are figh... ganisms into ... not taking th...

Though ... safety of the ... unconvention... method, known as biocompetitive exclusion, is gaining support as cheap, pesticide-free and accurate.

At the moment, the U.S. is losing the food poisoning war. The way food is produced and eaten today is making life ... ing can still happen.

Shouting Matches

Dr. Cotty wants to try his idea on an entire cotton valley in Arizona. But food-safety conferences have erupted into shouting matches over his biocompetitive ...

In the Lab

... concept. The ... ccessful 100% ... nes, a micro- International ... icultural seed ... bad chicken ...

...eful that the same principle might work on a range of livestock for other pathogens such as the E. coli strain that caused the Jack in the Box poisonings. But many questions remain, including whether the digestive system of a ruminant animal is too complicated for this process.

The most controversial biocompetitive project is run by Peter J. Cotty, a plant pathologist who decorates his Agriculture Department business card with a fungus ...

Others are worried about the safety of handling *Aspergillus flavus*. Toxic or not, the spores can grow in the lungs of people with weakened immune systems. And some seed companies are aghast that the government would consider releasing a fungus that would still infect plants even if it doesn't taint the crop with a carcinogen.

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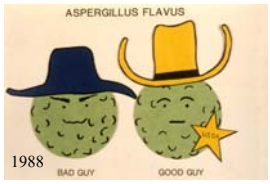
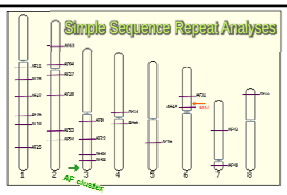
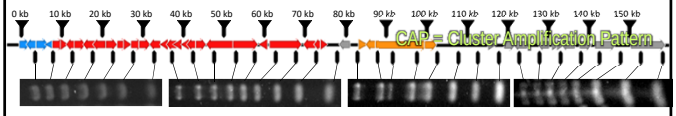
Dr. Cotty argues that his technique isn't any worse than farmers blindly modifying the microorganisms in their fields by working the soil. He says the technique doesn't change the fungal population in a field, just whether it is poisonous. "It is much more clever to select the fungi that will grow in our fields just like we select the plants," he says.

The Wall Street Journal
Tuesday March 16, 1993





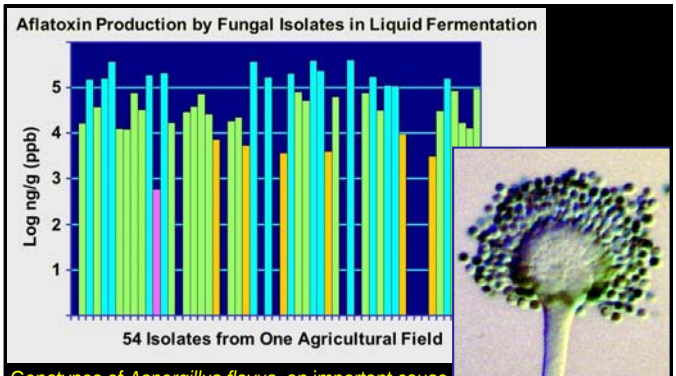


Aflatoxin Biocontrol in the US

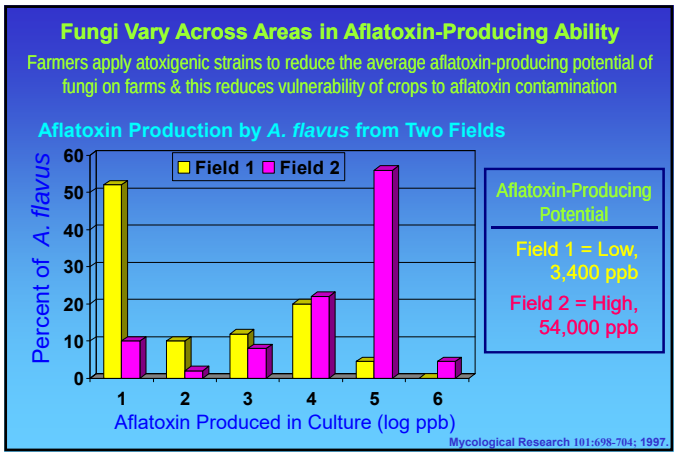
- First Patent Application: 1989
- First Conference with Environmental Protection Agency: 1992
- **Used on commercial crops in US since 1996.**
- Three Products Currently Registered
- **Over 1 Million Acres Treated Annually**
- Registered Target Crops: Maize Grain, Maize Silage, Pistachios, Cottonseed, Peanut
  (Almond & Fig in registration process).

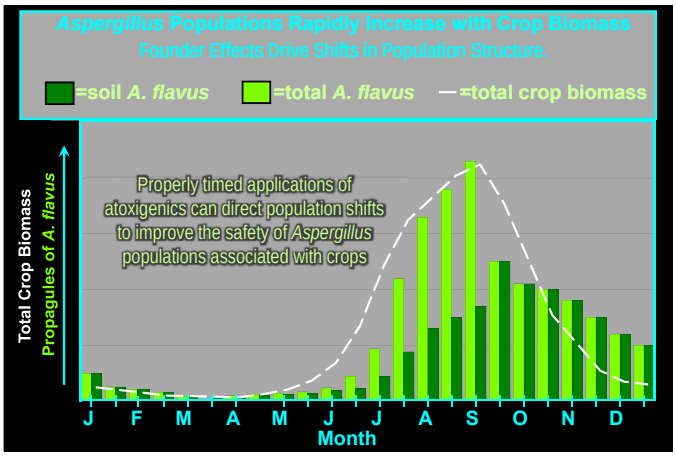
Biocontrol in Africa

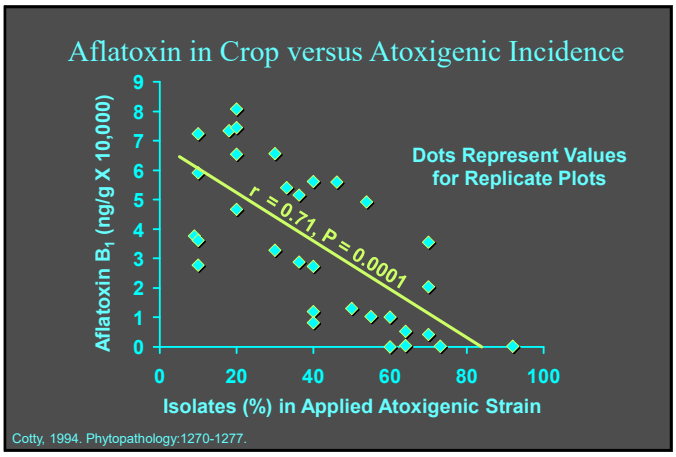
- There is Severe Human Exposure to Aflatoxins in Several African Nations.
- Products registered for use in Nigeria, Kenya, Senegal/Gambia.
- Target Crops: Maize & Groundnut.

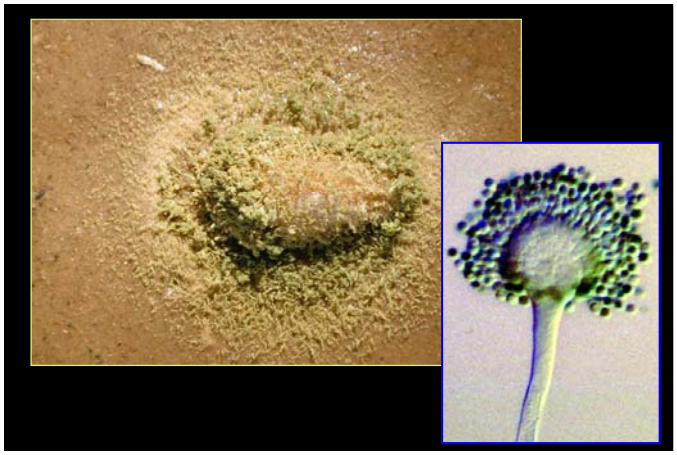


Genotypes of *Aspergillus flavus*, an important cause of aflatoxin contamination, vary widely in ability to produce aflatoxins.









Commercial Maize: North Central Texas 2008

Area	Samples (#)	AF36 (%)	Aflatoxin (ppb) Mean	Aflatoxin (ppb) Range
Grayson North	17	96 a	12 a	0 to 48
Grayson South	16	98 a	15 a	0 to 38
Grayson Control	8	24 b	230 b	5 to 530

Means in the same column with different letters are significantly different by Tukey's HSD test, P < 0.001.

Fungi move between fields and across areas.

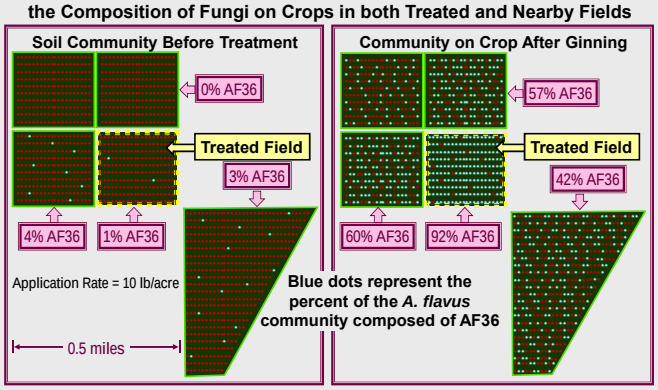
We can protect whole agricultural systems from aflatoxins including all affected industries and improve the environment.

Composition of *Aspergillus flavus* Communities in Soil of Treated and Nearby Fields in May 1996 Prior to Application of AF36 and in May 1997 One Year After Application

Field type	Fields (#)	AF36 (% *A. flavus*) 1996	AF36 (% *A. flavus*) 1997	S strain (% *A. flavus*) 1996	S strain (% *A. flavus*) 1997	*A. flavus* (CFU/gram) 1996	*A. flavus* (CFU/gram) 1997
Treated	3	4% ab	85% a	52% a	4% d	582 a	365 a
Adjacent	4	2% b	48% b	41% a	18% c	411 a	157 a
Diagonal	4	2% b	16% c	52% a	33% b	61 a	100 a
Other	4	9% a	9% c	43% a	50% a	109 a	98 a

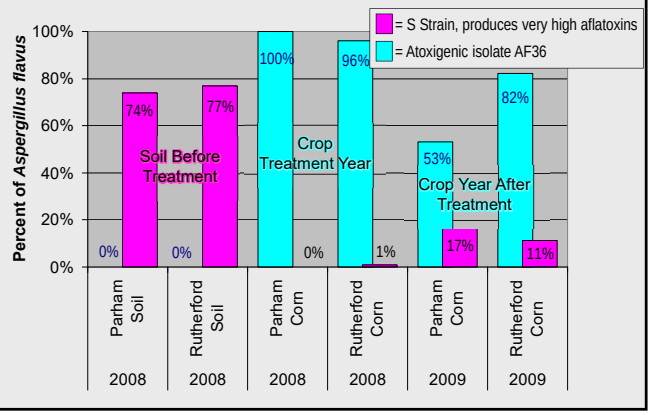
Other	Adjacent	Treated	Adjacent	Other	Other
Other	Diagonal	Adjacent	Diagonal	Other	Other

Application of Atoxigenic Strain AF36 in Commercial Cotton Influences the Composition of Fungi on Crops in both Treated and Nearby Fields

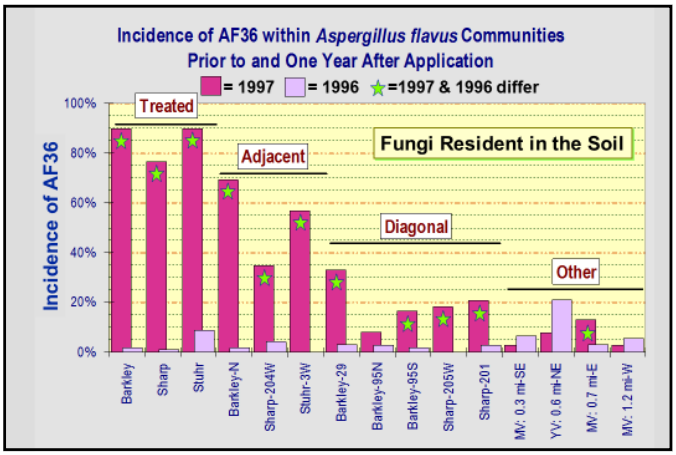


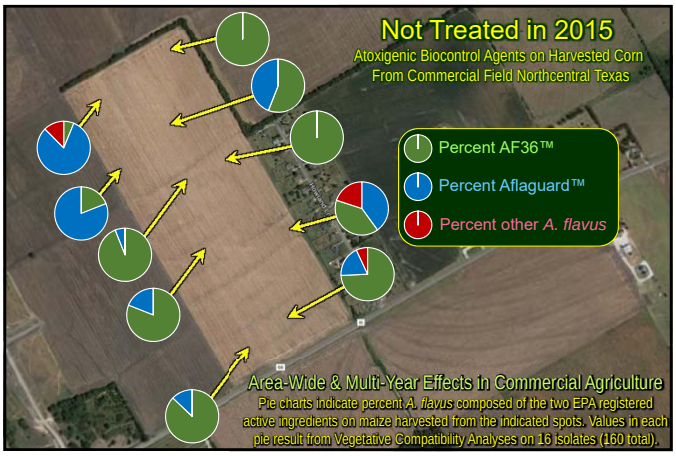
Data from 564 vegetative compatibility analyses.

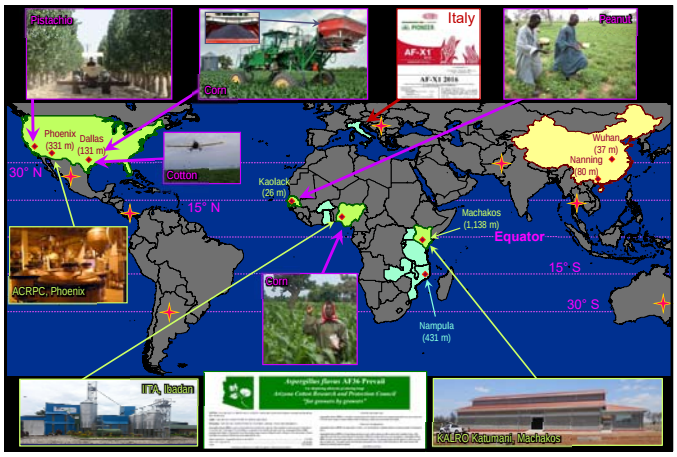
Grayson County, Texas: Carry Over to the Second Year Crop



Incidence of AF36 within *Aspergillus flavus* Communities Prior to and One Year After Application





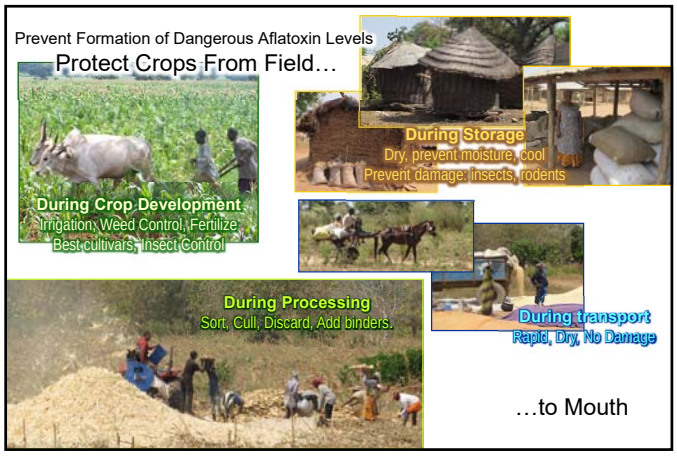


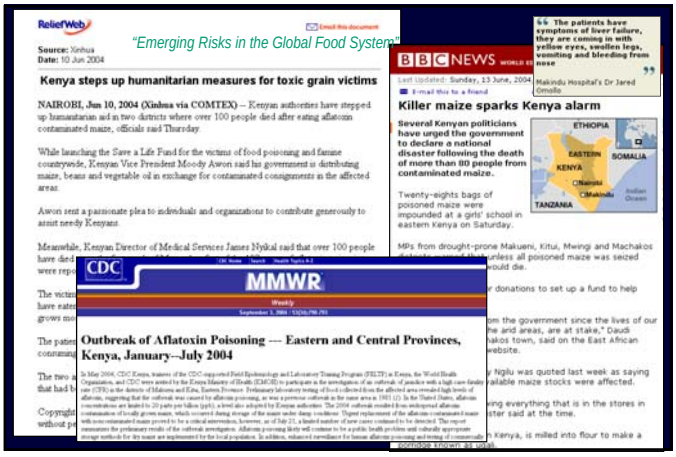
Since 2009 thousands of farmer's fields have been treated in Nigeria, Kenya, Senegal, Burkina Faso, Zambia, Tanzania, and Ghana.

Reductions in aflatoxin contamination consistently average over 80% both at harvest and after storage.

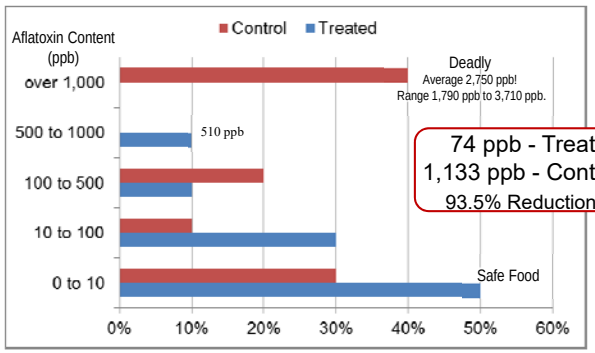
Single applications are made at 10 kg/hectare

As in the US, in Africa the biocontrol fungi survive between seasons allowing for long-term and cumulative benefit.





Mutomo, Kitui County, Kenya: 2012 Tests
Short Rain Season Farmer Field Trials



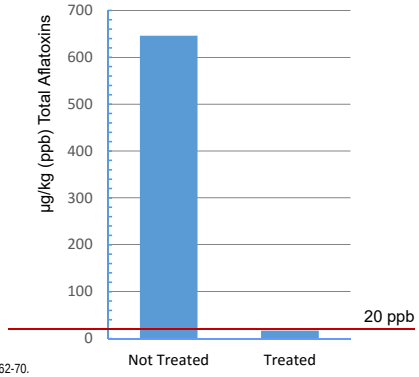
74 ppb - Treated
1,133 ppb - Control
93.5% Reduction

Selection of atoxigenics for Kenya: Probst, et al. 2011. Plant Disease 95:212-218.

Manufacture is easy. Biocontrol products like AF-X1 are made by a Farmer Organization in Arizona, and in a factory in Nigeria. Factories to make biocontrol products are under construction in Kenya and Senegal.

Atoxigenics stay with the crop from treatment,
.....through harvest, storage, and consumption.

Nigeria: Treated and control crops were harvested and stored under poor conditions for four months.



Atehnkeng, et al. 2014. Biological Control 72:62-70.

Biocontrol is Area-wide Management

Area-wide Aspects can be Optimized

Biocontrol fungi move from treated fields across areas

Atoxigenics persist in soils, on crop debris, on non-crop plants

Multiple Crops Benefit From the Same Biocontrol Fungus

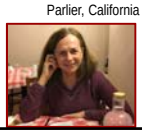
Area-wide Programs provide efficacy across cropping systems and additional health benefits. **Area-wide Programs** are less expensive (per hectare), provide for long-term commitment to aflatoxin elimination, protect all crops and remediate the area's reputation.

USDA Agricultural Research Service, USDA
School of Plant Sciences, University of Arizona

Work in Africa led by:
Dr. Ranajit Bandyopadhyay
Int. Institute Tropical Agriculture
Ibadan, Nigeria

Work on Tree Crops led by:
Dr. Themis Michailides
University of California, Davis
Parlier, California

Work in Italy led by:
Dr. Paola Battilani
Universitá Cattolica del Sacro Cuore
Piacenza, Italy



Crops are infected by complex communities of diverse fungi
We can influence aflatoxin-producing ability of fungal communities resident in production areas through crop rotations, agronomic practice, and by applying atoxigenic strains

There are many atoxigenic strains
Select strains best adapted to rotations, ecosystems, & climates

Atoxigenics are Already Present on the Crop
Just increasing the frequency of endemic strains & natural interference with contamination

Treatments have Long-Term Influences & Cumulative Benefits

All Crops in an Area May Benefit From Applications

Atoxigenic Strains can be Applied Without Increasing Infection
and without increasing the overall quantity of *A. flavus* on the crop & throughout the environment