

Plant Path

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7. Title Studies on Aspergillus Flavus and Biological Control of Aflatoxin Contamination of Louisiana Corn				
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Outputs: The Syngenta Afla-guard tests alone and in combination with Louisiana Aspergillus strains improved protection against aflatoxin contamination of grain. There appear to be three A. flavus strains (potential products) from Louisiana which when individually combined with Afla-guard increase non-toxigenic biological control of aflatoxin contamination of corn. One of them also performed well alone. Further analysis of the collection of isolates of this vcg revealed ~20 of the 483 isolates which failed to produce aflatoxin and ~5 of these failed to produce another mycotoxin, cyclopiazonic acid. These five are candidates for further testing as putative biocontrol strains. All these results were reported to the Louisiana Soybean and Grain Research and Promotion Board. Research demonstrated a 100-fold improvement in efficacy of itraconazole treatment to inhibit A. flavus when the antifungal was encapsidated in nanoparticles. This information was shared commercial industries.				
Outcomes/Impacts: These results are supported by the work of Huang et al 2011, which documents the specificity of intraspecific aflatoxin inhibition among various strains of A. flavus, and provides the mechanistic basis of the inhibition as being mediated by physical interaction resulting in a thigmo-down-regulation of aflatoxin synthesis. The improvement in efficacy is most likely related to the broader specificity of intraspecific aflatoxin inhibition achieved by the differing complementary spectra of inhibition by the various isolates. Experiments to follow up on the previous results suggested the importance of mating type in corn infection. They indicate a strong bias toward corn infection by A. flavus strains of mating type 1-2 rather than 1-1. Further analysis of these results revealed that the predominant (~80%) vcg infecting corn in 2007 was a very low toxin producer while the next most frequent (~10%) was a very high toxin producer when cultured on sterile rice. This result suggested the possibility that the predominant vcg was an example of a natural "native" biocontrol strain. The extremely high frequency (>95%) of corn kernel isolates of the Mat1-2 mating type strongly suggests that Mat1-2 which is a transcriptional activator of genes is turning on genes which enhance corn infection. All of these biocontrol isolates are Mat1-2 which further supports the importance of kernel infection by the biocontrol strains in mediating control. The occurrence of the putative "native" biocontrol strain provides an explanation of why aflatoxin contamination outbreaks are absent when environmental conditions are conducive. Nanoparticles encapsidating or covalently labeled with a fluorescent probe were almost immediately internalized into the fungus hyphae where the fluorescence was observed. Nanoparticles were endocytosed by the fungus thus providing a "Trojan horse" explanation of the increased antifungal efficacy.				
Publications: Huang, CW, Jha, A, Sweany, R, DeRobertis, C, Damann, KE. 2011. Intraspecific aflatoxin inhibition in Aspergillus flavus is thigmoregulated, independent of vegetative compatibility group and is strain dependent. PLoS ONE 6(8):e23470. doi:10.1371/journal.pone.0023470. Sweany, RR, Damann, KE Jr, Kaller, MD. 2011. Comparison of soil and corn kernel Aspergillus flavus populations: evidence for niche specialization. Phytopathology 101:952-959. Patel, NR, Damann, K, Leonardi, C, Sabliov, CM. 2011. Size dependency of PLGA-nanoparticle uptake and antifungal activity against Aspergillus flavus. Nanomedicine 6(8):1381-1395. Danmek, K, Prasongsuk, S, Lotrakuk, P, Damann, K E, Eveleigh, D E, Punnapayak, H. 2011. Effect of Avid on the synnema-like formation of Aspergillus flavus grown on Czapek medium. African Journal of Microbiology Research 5(18):2812-2815.				
Participants:				

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Target Audiences:

Louisiana corn industry and National Corn Growers.

Project Modifications:

Expansion of the field testing of biocontrol isolates to a broader audience (Arkansas, Mississippi), through support of the Texas Corn Growers AMCOE grant program.

Approved (Signature)	Title	Date
		