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Rapid Detection of *Aspergillus flavus* in Corn
Final Report for the Texas Corn Producers Board

In the last update, Fourier Transform-Infrared (FT-IR) spectrophotometry was successfully used to detect strains of *Aspergillus flavus* in corn fields. We are continuing to move forward assessing the feasibility of using FT-IR to identify and quantitate aflatoxin present on corn kernels. In an on-going study, we used a cobb of corn that was grown in the field and was inoculated by single kernel injection with *Aspergillus flavus* 3357 for 21 days. Nine kernels were infected directly on the cobb, and we analyzed the kernels by FT-IR to ascertain if we could identify the presence of the fungus. We used two treatment sets: the side of the cob that was infected was called "infected kernels" and then we used the other side of the cobb as a control set and named it "uninfected". The instrument used was an Agilent 4500 FT-IR equipped with a single-bounce ATR.

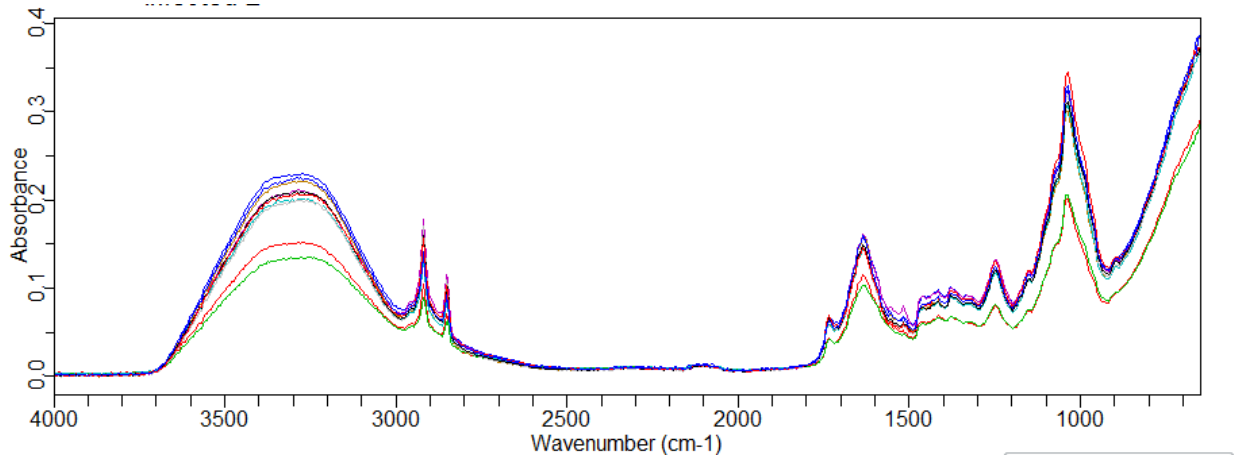

Figure 1: Infected Kernel Spectra

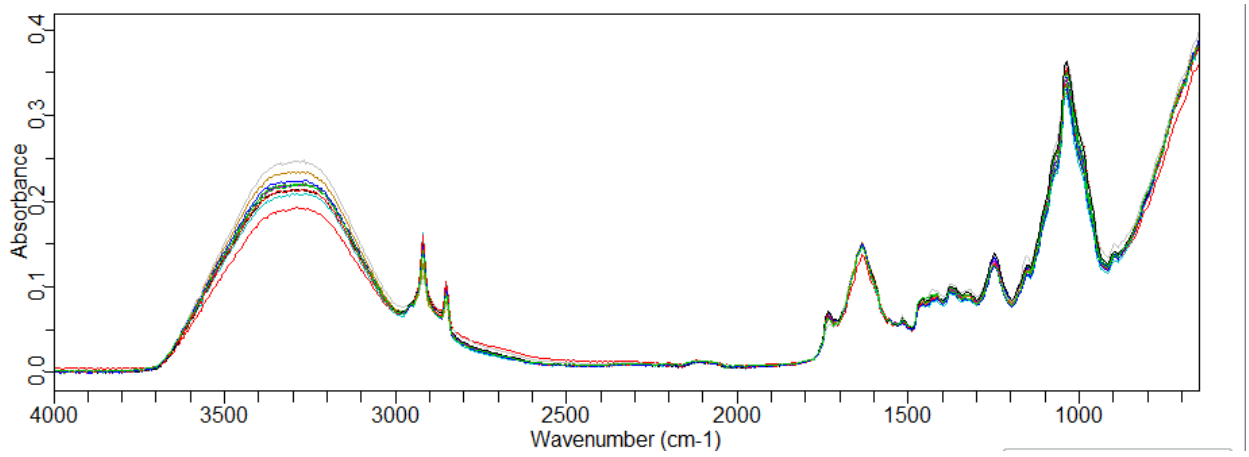

Figure 2: Uninfected Kernel Spectra

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Figures 1 and 2 show the spectra collected from infected and uninfected corn kernels, respectively. From the data sets, we noticed a difference present between the two sets. The region at ~1500 cm^{-1} had a noticeable trend that varied from kernel to kernel in the infected set, but stayed nearly constant in the uninfected. This area of interest was then used to see if there was a statistical difference via principle component analysis (Figure 3).

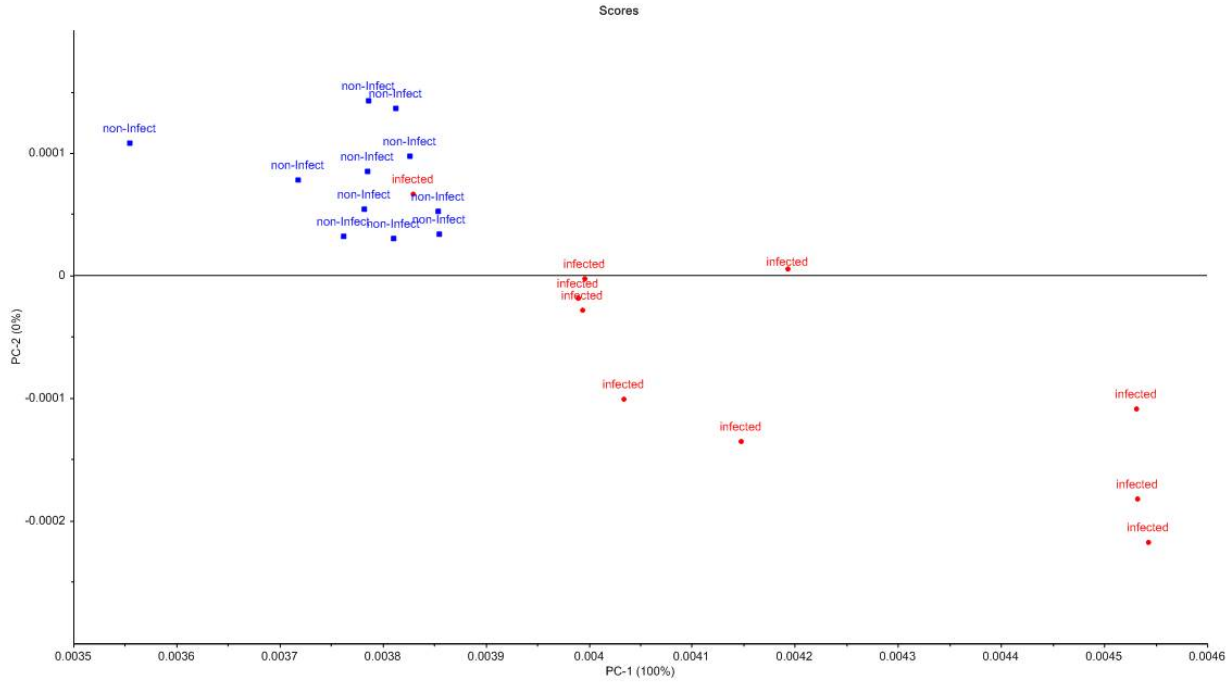

Figure 3: Principle Component Analysis of Kernels (infected side is labeled in red, while the uninfected is labeled in blue)

From the analysis, it was apparent there was a noticeable trend in the two data sets, with the exception of one infected side kernel. It is yet unknown if this correlates to the presence of aflatoxin, but does offer a hint as to what FT-IR could be used for in identifying infection levels on the kernel that could ultimately be used to quantitate aflatoxin on corn.

In summary, the objective of this project was to evaluate the feasibility of using mobile infrared as an onsite diagnostic tool for determining the presence of aflatoxigenic fungi, particulary *Aspergullus flavus*. Our results over the course of this project show that this technique is robust enough to be used in the field for onsite detection. Future work in this area will focus on correlation of FT-IR spectra with actual aflatoxin contamination levels to build a model that will not only identify a fungal strain but also indicate the presence and resulting quantity of aflatoxin contamination.

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Publications

- Atkinson, C., O. Pechanova, **D.L. Sparks**, A. Brown, and J.M. Rodriguez, 2013, "Differentiation of Aflatoxigenic and Non-Aflatoxigenic Strains of Aspergilli by FT-IR Spectroscopy," *Applied Spectroscopy*. Accepted for Publication.
- Womack, E., A. Brown, and **D. Sparks**, 2013, "A Recent Review of Non-Biological Remediation of Aflatoxin-Contaminated Crops," *Journal of the Science of Food and Agriculture*. Accepted for Publication.

Oral Presentations

- Brown, A., C. Atkinson, and **D. Sparks**, "Identification of Agricultural Phytopathogens by Mobile FTIR," ASTS-Environmental and Food Safety Series Webinar Sponsored by Agilent Technologies and ACS, March 5, 2013.
- Atkinson, C., **D. Sparks**, A. Brown, and J. Rodriguez, "Toxigenicity Detection by FT-IR," 245th ACS National Meeting, New Orleans, LA, April 7-11, 2013.
- **Sparks, D.L.**, C. Atkinson, and A. Brown, "Early Detection of Phytopathogens in Crops Using Portable FTIR," ASFFPCO 71st Annual Meeting, Wilmington, NC, June 19-21, 2013. (Invited Lecture)

Poster Presentations

- Reid, C., E. Mylroie, W.P. Williams, A. Brown, and **D. Sparks**, "Single Corn Kernel Aflatoxin Detection," 245th ACS National Meeting, New Orleans, LA. April 7-11, 2013.
- Atkinson, C., A. Brown, **D. Sparks**, and G. Hagood, "Prep-Free Differentiation of Agriculturally Important Fungi by FT-IR Spectroscopy," AOAC Southern Section Annual Meeting, Atlanta, GA, April 22-23, 2013.
- Brown, A., C. Atkinson, F. Prulliere, and **D. Sparks**, "Agricultural Phytopathogens Identified via Portable FT-IR," Gordon Research Conference on Mycotoxins and Phycotoxins, June 16-21, 2013. (Invited Poster)

Leveraging of Funds

- Mississippi Corn Promotion Board. DECREASING THE IMPACT OF AFLATOXIN ON CORN AND DISTILLERS GRAINS ($41,980 for 1yr).
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