



## Incidence and Distribution of *Fusarium* species Associated with Hemp in Kentucky

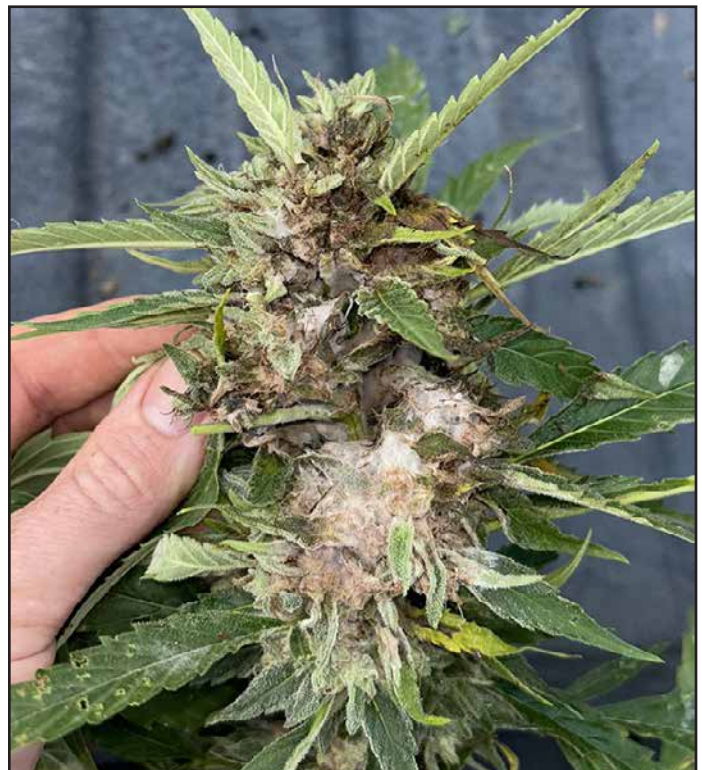
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*Fusarium* head blight (FHB) (FIGURE 1) was first documented in Kentucky in 2018 and reported in 2020. Since then, disease has been reported across the continental U.S., with the majority of cases in states east of the Mississippi River. There have been multiple species identified as causal agents of FHB including *Fusarium avenaceum*, *F. graminearum*, *F. incarnatum-equiseti* species complex members, and *F. sporotrichioides*. These species are also causal agents of FHB (scab) in cereal crops.

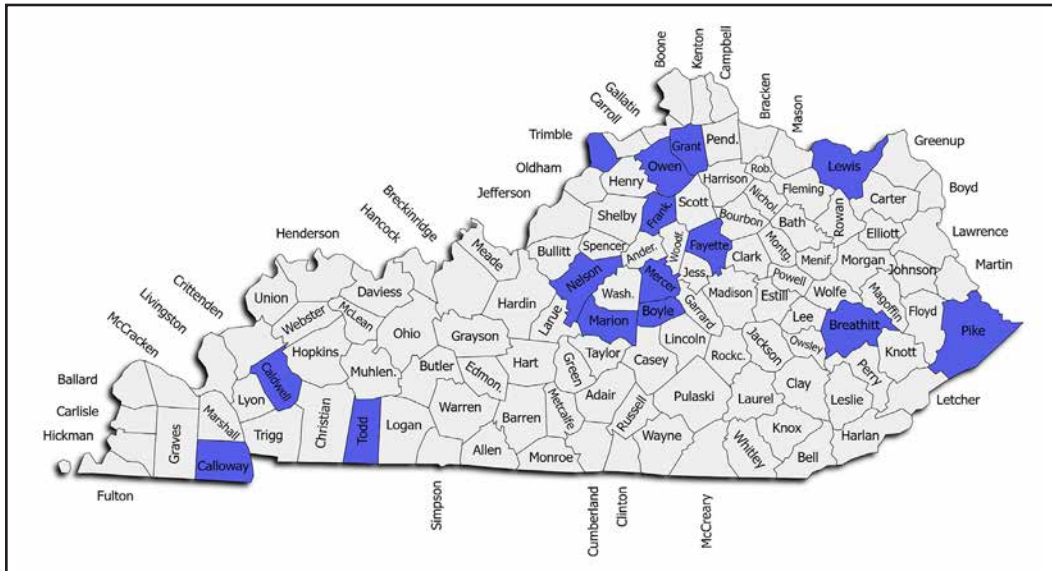
*F. graminearum* and *F. sporotrichioides* have been observed to cause the most severe disease in Kentucky. These species belong to the *Fusarium sambucinum* species complex (FSAMSC). In addition, members of the FSAMSC complex produce trichothecene mycotoxins (DON & T2) that are harmful to humans and livestock. In response to an increase in FHB in Kentucky, a statewide survey was conducted to determine the incidence and distribution of these toxigenic *Fusarium* species associated with hemp.

During the 2022 hemp growing season, 26 fields were surveyed across 15 different Kentucky counties (FIGURE 2). Three fields were surveyed three times, 15 fields were sampled twice, and seven fields were sampled once during the growing season. If a site was surveyed multiple times, each survey visit was conducted approximately one month apart. Samples were collected by walking each field in a W-shaped pattern, collecting samples of diseased floral tissue from 30 different plants. Fungal isolates were cultured in the laboratory. Resulting fungal isolates were identified by morphological (spore) characteristics and species-specific PCR or DNA sequencing.

A total of 750 diseased floral samples were collected in the survey. From these samples, 359 isolates of *Fusarium* were obtained, resulting in a 47.8% isolation rate. Fungal isolates included species within the *Fusarium fujikuroi*, *incarnatum-equiseti*, *lateritium*, *oxysporum*, *tricinctum*, and *sambucinum* species complexes. The FSAMSC members, *F. graminearum* and *F. sporotrichioides*, were isolated at an average rate of 8.5%. The FSAMSC isolation rate varied substantially among sites, ranging from 0% to 46.6%. A correlation was identified between calendar day and FSAMSC isolation rate ( $\rho=0.45$ ). A significant correlation was also observed between plant age and FSAMSC isolation rate ( $\rho=0.47$ ). Isolation rates peaked in late September when plants were 11-13 weeks old, aligning with the time period when most plants were in the late reproductive stages (FIGURES 3 & 4).



**FIGURE 1.** A HEMP PLANT PRESENTING SYMPTOMS OF FUSARIUM HEAD BLIGHT (FHB). ABUNDANT MYCELIA TYPICALLY APPEAR DURING PERIODS OF HIGH HUMIDITY OR FOLLOWING RAIN EVENTS.



**FIGURE 2.** A TOTAL OF 26 FIELDS WERE INCLUDED IN THIS SURVEY ACROSS 15 KENTUCKY COUNTIES. THE SURVEYED COUNTIES ARE COLORED BLUE.

Potential factors involved in the variable isolation rates were identified based on field observations and grower interactions.

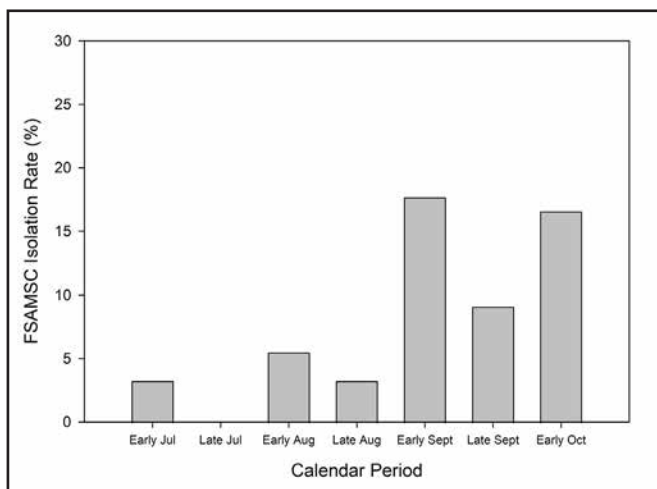
*First*, a large number of cultivars were included in this survey, and certain cultivars may have had levels of genetic resistance. Some of the cultivars also possessed different floral architectures that allowed for better airflow to interior tissues, resulting in an environment that was less conducive to disease development.

*Second*, weed pressure differed among production sites. Grassy weeds are documented hosts for *Fusarium* species and can serve as sources of inoculum.

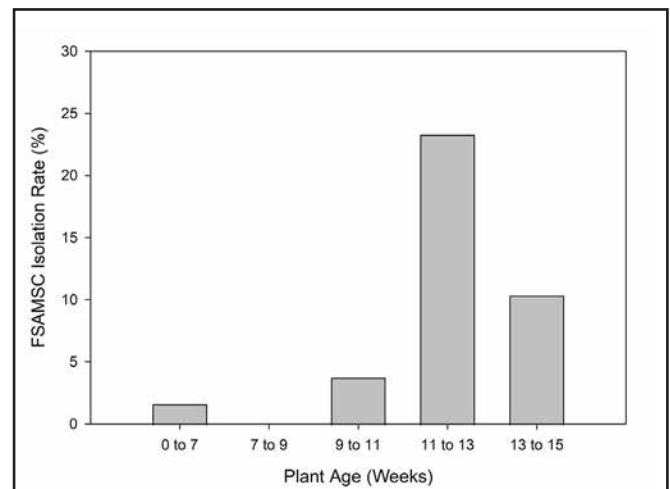
*Third*, there were significant differences in the amount of corn earworm (*Helicoverpa zea*) feeding in the surveyed fields. Insect feeding has been found to increase *Fusarium* disease pressure in other cropping

systems (e.g. *Fusarium* ear rot of corn). Studies are ongoing to investigate the impact of each of these factors on FHB severity in hemp cropping systems.

The average FSAMSC isolation rate of 8.5% suggests that mycotoxin contamination of diseased floral tissues is possible. A formal mycotoxin survey has not been conducted on harvested hemp material. Currently, there are no testing requirements for *Fusarium* mycotoxins such as DON and T2 in hemp. Methods for accurate mycotoxin quantification are in development and will be used in subsequent surveys to better assess mycotoxin risk. This survey confirmed that FHB of hemp is a statewide issue, and growers should review management recommendations pertaining to FHB to prevent losses.



**FIGURE 3.** FSAMSC ISOLATION RATES THROUGHOUT THE HEMP GROWING SEASON. AS THE SEASON PROGRESSED, ISOLATION RATES INCREASED.



**FIGURE 4.** FSAMSC ISOLATION RATES ACROSS DIFFERENT PLANT AGE RANGES. THE ISOLATION RATES WERE HIGHEST WHEN PLANTS WERE IN THEIR LATER REPRODUCTIVE STAGES.

## REFERENCES

*Research studies referenced for this report can be found in the following scientific journal articles*

- Smith, H. S., Szarka, D., Dixon, E., Adedokun, O., Munir, M., Ricciardi, M., Schroer, R., Gauthier, N. 2023. Emerging *Fusarium* spp. Causing Head Blight on Hemp in Kentucky. Plant Health Progress 24(2): 132-134
  
- Smith, H. S., Dixon, E., Munir, M., Gauthier, N. 2024. Incidence and Distribution of the *Fusarium sambucinum* Species Complex Associated with *Cannabis sativa* in Kentucky. Plant Health Progress 25(3): 316-323
  
- Yulfo-Soto, G. E., Smith, H., Szarka, D., Dixon, E., Vaillancourt, L., Gauthier, N. 2022. First Report of *Fusarium graminearum* Causing Flower Blight on Hemp (*Cannabis sativa*) in Kentucky. Plant Disease 106(1): 334

*February 2025*

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**Photo:** Henry Smith, University of Kentucky

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