THE OHIO STATE UNIVERSITY OARDC

More than 40 years of observations from Ohio confirm the importance of relative humidity and precipitation for Fusarium head blight epidemics

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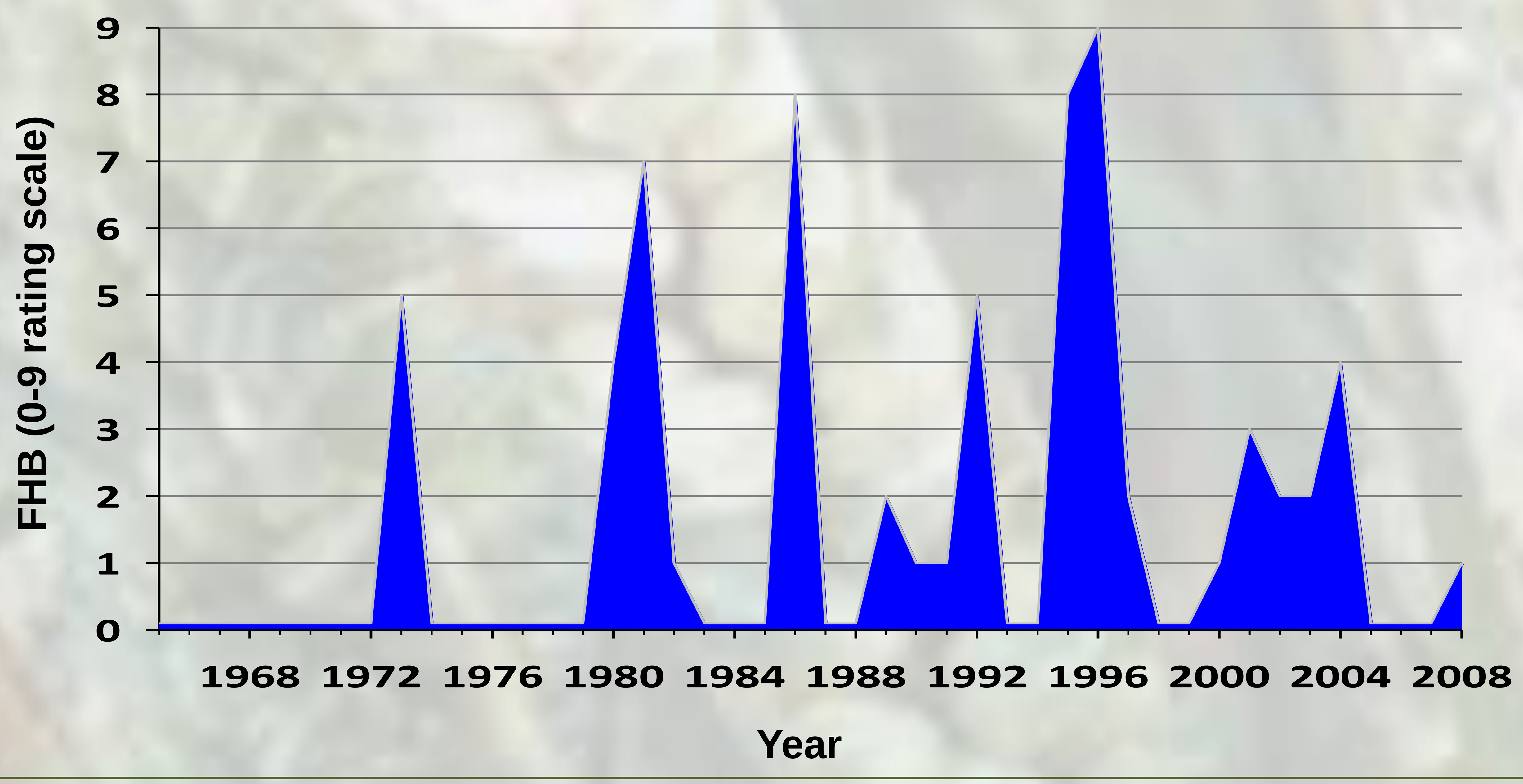
INTRODUCTION:

Short-term weather and long term climatic conditions over the winter wheat growing season in Ohio were investigated to determine if the variability in environmental variables from year to year influences the sporadic nature of Fusarium Head Blight.

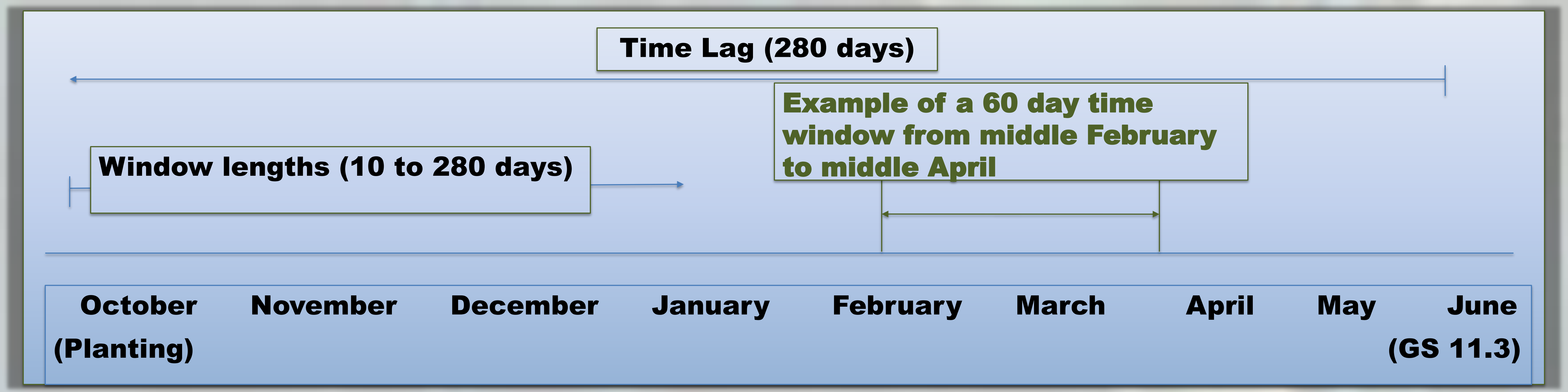
ABSTRACT:

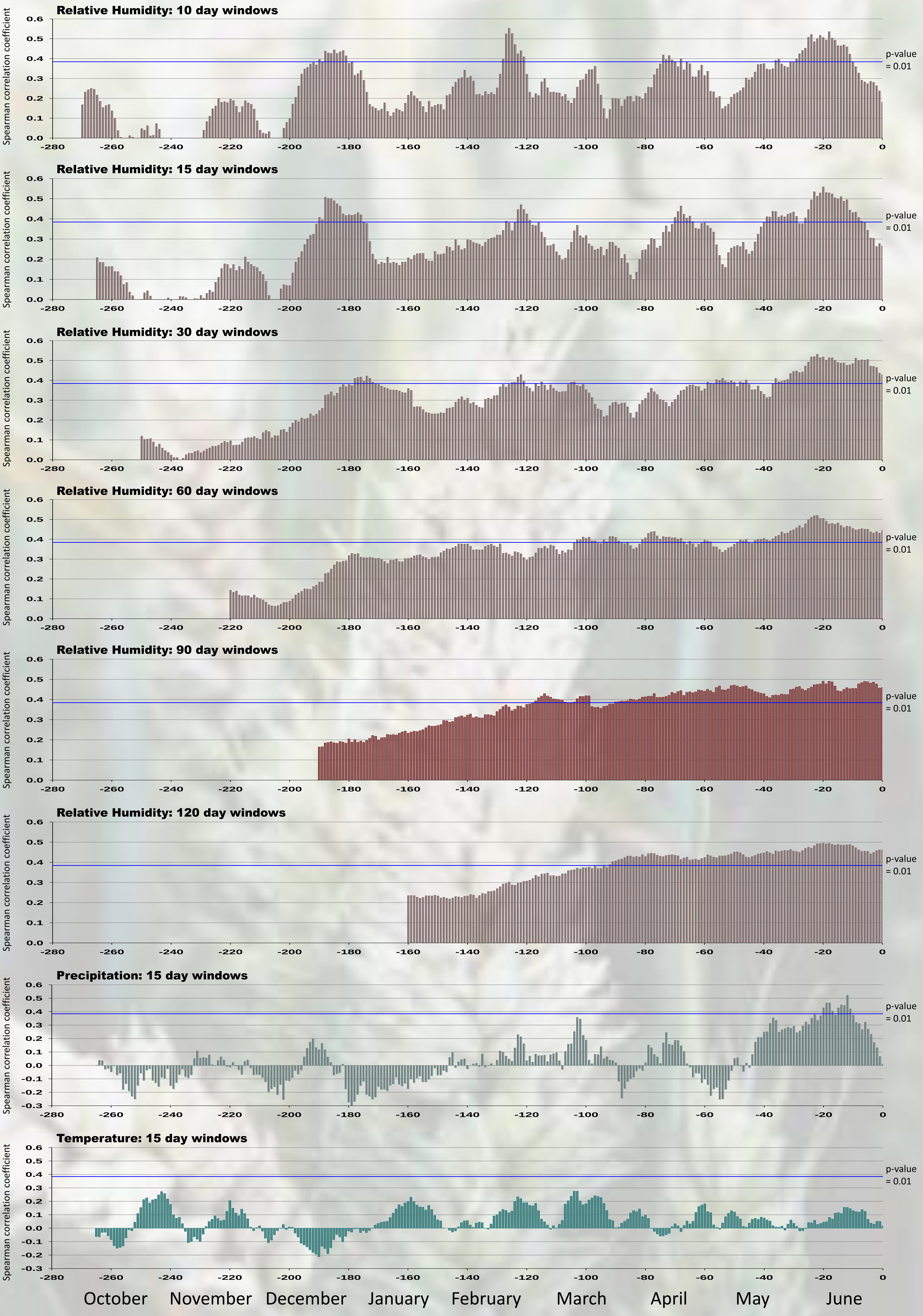
Fusarium head blight (FHB) of wheat, caused by *Fusarium graminearum*, is a sporadic disease that is dependent, at least in part, on weather and climatic conditions. The goal of this research was to identify environmental variables that are related to FHB over time. For each of 44 years (1965 - 2008), an ordinal assessment of FHB in Ohio was performed, based on the magnitude of disease symptoms, DON in grain, and yield-loss estimates. Weather data were gathered from local weather stations, and summary variables were calculated for a wide range of time windows and starting times of the windows during the wheat growing season. The windows ranged from 10 to 280 days in duration, beginning at June 30 (physiological maturity) and proceeding backwards to September 24 of the previous year (planting time). Based on Spearman rank correlations, FHB was significantly ($P < 0.05$) associated with average daily relative humidity and total daily precipitation for short- and long- time windows. FHB rating and RH were significantly correlated throughout the growing season, including both early and late spring, but FHB and precipitation were significantly correlated in late spring only. Weather variables that have been identified in this analysis may be used to potentially improve the national FHB forecasting system.



METHOD:

- For each of 44 years, an ordinal assessment of FHB in Ohio was performed, based on the general magnitude of disease symptoms, DON in grain, and yield-loss estimates.
- Each year was given a rating between 0 and 9, and quantitative relationships between the ratings and weather variables were investigated for the period from 1965 to 2008.
- Weather data were gathered from weather stations near Wooster, Ohio, and summary variables (such as average RH, temperature, and precipitation) were calculated.
- 'Window Pane' analysis, a data mining protocol originally developed by Coakley and colleagues in 1982, was used for identifying relationships between disease and weather -climate variables within specified time periods.
- Time frames or windows used for this analysis ranged from 10 to 280 days in duration, beginning June 30 (around harvest) and proceeding back to September 24 of the previous year (about the time of planting).
- Spearman rank correlation coefficients were calculated to identify the time periods in which weather variables showed significant effects on the FHB rating.





RESULTS:

- FHB rating and average relative humidity were significantly ($P < 0.01$) correlated for short time windows (e.g., 10-30 days in duration) in both early and late spring, covering the period for spore production, infection, spike colonization and DON production. There were also significant correlations of FHB with average relative humidity during the winter months.
- Average relative humidity for long time windows (e.g., 180 and 210 days) was also significantly correlated with FHB rating, likely reflecting the combined impact of RH during separate shorter windows.
- FHB rating and precipitation were significantly correlated ($P < 0.01$), but only for 15- and 30- day windows in late spring.
- No significant relationships between average daily temperature and FHB were found for any time window.
- Correlations between FHB and average relative humidity were stronger with shorter window lengths.

CONCLUSIONS:

Analysis confirms previous reports that FHB on winter wheat is related to RH and precipitation. Interestingly, RH during time windows close to -- as well as many months before -- harvest were positively related to FHB. In future work, additional weather variables will be considered and models will be developed that may potentially improve the FHB forecasting system.