Smart Ag Research

Evaluation of Remote Sensing Technology to Identify Agriculture Disease Spores

SporeScout units from the BioScout company of Australia were installed at Olds College Smart Farm. Researchers used the devices from 2023 to 2024 to detect disease – causing pathogenic spores and evaluate the technology's performance in real-world conditions. The Smart Farm is a living laboratory on campus for crop, livestock and agricultural technology spread over 3,000 acres.

INTRODUCTION

Accurate disease risk assessment is crucial in determining the appropriate timing for fungicide application, as incorrect timing may result in ineffective disease control, resistance and potential disease mutation.

SporeScout units can help producers to accurately identify and quantify the disease in real time. Using a fan, spores are drawn into the sensor where particles adhere to a sticky trap and are photographed using microscopy. The images are then analyzed by Bioscout's AI by comparing them to the in-built database for accurate disease identification. This real-time disease data can help producers with more timely application of fungicides and improved treatment efficacy.

The Olds College Smart Farm is a key member of Pan-Canadian Smart Farm Network, which is working to bring smart farm agriculture technologies to producers in Western Canada. As part of this effort, the Smart Farm and other network members tested BioScout devices to evaluate their performance and efficiency in detecting pathogens that cause crop diseases. Scouting activities conducted at the Smart Farm provided insights into how this technology performed in real-world conditions, offering insights into its potential benefits for Canadian farmers.

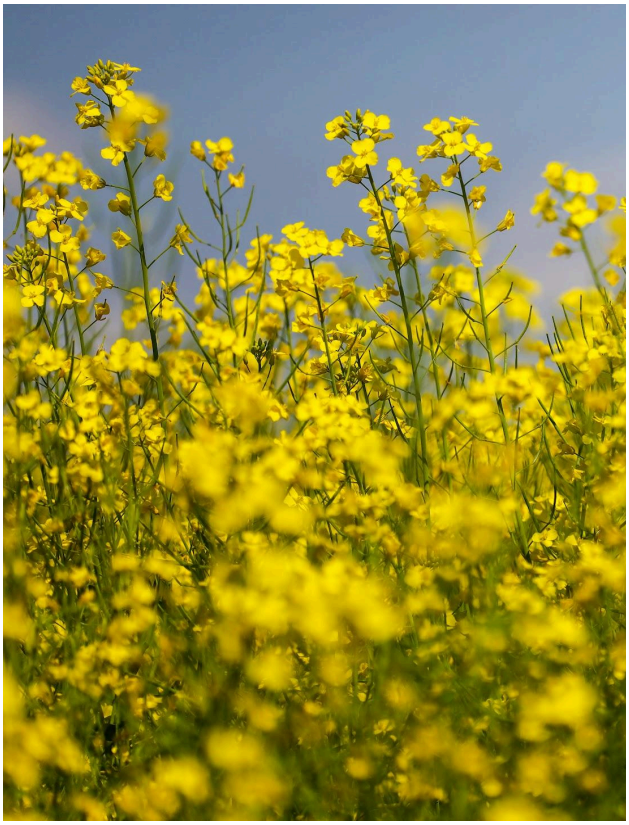
OBJECTIVES

- Measure the spore concentration of airborne diseases spore using BioScout SporeScout device.
- Analyze spore concentration data to assess disease risk to help predict the likelihood of infection.
- Assess BioScout's effectiveness by tracking specific crop pathogenic spores in real-world conditions.

STUDY DETAILS & RESULTS

The research project monitored airborne fungal spores from 2023 to 2024 at the Smart Farm. From August to October 2023, the device was installed at Field 19 and the weather station array to track blackleg and general rust spores.

For the second season, the devices were installed in May 2024, expanding the focus to include cereal powdery mildew,



Botrytis, and general Alternaria spores, in addition to blackleg and general rust.

The system operated through a precise workflow. It collected airborne particles on an adhesive surface, and an automated microscope system then imaged the collected samples. These images were uploaded to secure cloud-based software, where an artificial intelligence program identified and categorized the spores with built-in quality control measures. Finally, the system calculated the spore concentration and displayed the results on a user-friendly dashboard:

- Throughout both seasons, blackleg spore concentration remained consistently below the threshold of 15 to 20 spore/m^3 of air. However a single isolated peak was observed at the Olds College wheat trial on Oct.11, 2023.
- General rust spore levels were mostly low to moderate during the first season with two significant spikes observed in late September and mid-October. The levels remained low in the second season except for the early September, slightly earlier than the previous season.

- Cereal powdery mildew appeared to pose no significant threat to crops due to low spore levels detected throughout both seasons with only a few moderate spikes, suggesting effective management.
- A significant spike of Alternaria leaf blight between early August and early September in the second season indicated a potential infection risk during this period, likely in canola crops.
- Towards the end of the season, botrytis rot spore levels seemed to increase progressively from low to moderate, likely due to conducive environmental conditions. This suggested a strong potential risk for increasing infection towards the end of the season.
- Results indicate that BioScout's SporeScout units can be utilized for continuous measure of spore concentration in the field. The real-time data they collected also has a strong potential to enhance disease management by assessing disease risk, and supporting timely disease control, including fungicide application decisions for the Pan-Canadian Farm Network, agronomists and the broader industry.

NEXT STEPS/FUTURE RESEARCH

Improve SporeScout reliability through development of a model that includes:

- Improved connection reliability
- The option to work on Wi-Fi instead of 4G
- More efficient power usage
- The ability to operate on mains power
- Easier updating processes for continuous performance improvements
- Development of a model that is capable of predicting the infection risks by detecting when conditions are ideal for infection, and adjusts risk levels based on the presence of disease-causing spores. This integrated approach will improve understanding of infection risks and help optimize disease management for crops.