Project Summary

EMILI CELLARINSIGHTS

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Cellar Insights Smart Storage Monitoring

About the technology

Cellar Insights Smart Storage Monitoring uses predictive analytics in potato storage systems to deliver early warnings on spoilage risk, shrink, and quality degradation to reduce losses for growers and processors. This commercial technology remotely monitors temperature, humidity, carbon dioxide (CO_2), and rot gas levels to ensure optimal storage conditions and maximize crop value.



Cellar Insights Smart Storage Monitoring sensor installed in a potato storage facility at Innovation Farms MacGregor (Photo credit: EMILI).

EMILI objectives

Throughout 2025-2026, EMILI deployed Cellar Insights sensors in a potato storage facility at Innovation Farms MacGregor in order to:

- Demonstrate the ability of the Smart Storage Monitoring system to accurately remotely monitor the storage quality of potatoes.
- Support the continued development of Cellar Insights' machine-learning models by gathering meaningful storage data through various sensors.

What we learned

Remote monitoring

The Cellar Insights web-based application is accessible through any browser or mobile device, allowing for convenient, on-the-go monitoring. Growers can monitor variables in real-time and customize SMS notifications to receive alerts when variables fall outside target ranges. This quick, accessible view of storage facilities limits the needs for frequent, time-consuming physical inspections.

Early spoilage detection

Rot sensors function like an "electric nose" within the storage facility, sensing airborne gases produced by rotting potatoes, an early indicator of decay. These sensors provide absolute measurements in parts per million, enabling growers to detect subtle changes and identify trends. This proactive monitoring system detects produce spoilage at an early stage, significantly reducing the risk of wide-spread product spoilage.

High risk storage environments

The monitored storage facility has demonstrated stable storage conditions with no significant anomalies, showcasing the system's ability to confirm optimal conditions. Expanding monitoring to higher-risk facilities could provide greater insight into the system's abilities across a broader range of environments and higher exposure to spoilage risks.



What this technology could unlock

Smart Storage Monitoring shifts perishable crop storage from a reactive process into a proactive, data-driven system. By combining real-time environmental and produce quality monitoring with predictive analytics, this technology enables earlier detection of storage quality risks, helping the potato industry reduce food waste and improve the overall value and profitability of stored crops.

EMILI INNOVATION FARMS powered by AgExpert

EMILI's Innovation Farms powered by AgExpert provides innovators with access to leading-edge equipment, technology, and production practices to increase productivity, sustainability, and profitability across the agriculture and agri-food sector.

Summary of analyses

Materials and methods

Cellar Insights Smart Storage Monitoring hardware was deployed in a 300,000 hundredweight (CWT) Hammer-Lok/Techmark storage facility. IoT sensors were installed throughout the bin and collected temperature, humidity, CO_2 and rot gas recordings from the plenum, return, and storage on a thirty minute basis throughout the storage season.



Cellar Insights Smart Storage Monitoring hardware installed in a potato storage facility.

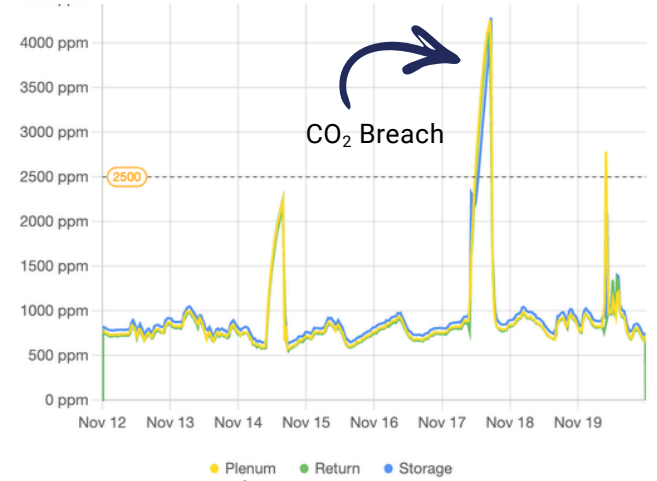


Figure 1. CO_2 breach from sprout inhibitor application.

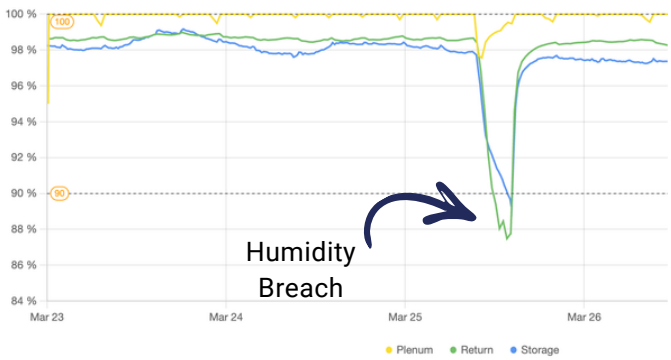


Figure 2. Humidity breach from manual fan shut off.

Results

Sprout inhibitor treatment applied to stored potatoes

CO_2 and rot gas levels falling outside the customized target ranges were flagged on the Cellar Insights platform due to a Chloropropham (CIPC) sprout inhibitor treatment applied to the stored potatoes. A Smart Storage Monitoring sensor deployed in the storage bin was left uncovered during the time of treatment, providing an opportunity to test the system's ability to detect and record gases released during the application. The set target range for CO_2 was less than 2,500 ppm, with the spike showcasing CO_2 levels reaching 2,622 ppm. The rot gas levels spiked to 1.49, with the target range set to less than 0.5 (Figure 1). The Smart Storage Monitoring system successfully captured the resulting changes, demonstrating the sensitivity of the rot sensors and their ability to detect changes in the storage environment that may otherwise go unnoticed.

Manual shut-off of storage facility fan

Fans in the monitored storage facility were manually turned off, causing an increase in temperature and corresponding decrease in humidity. A humidity breach, caused by the measured humidity levels moving outside the 90-100% target range to 88.9%, was detected and displayed in the Cellar Insights platform (Figure 2). The breach detection by the Smart Storage Monitoring system and the corresponding alert demonstrates the technology's ability to generate actionable insights in real-time.

Techmark integration

With Cellar Insights' recent Techmark integration, data from additional storage facilities at Innovation Farms MacGregor can be brought into the platform without the installation of duplicate sensors. This integration allows for broader visibility across the farm and continued collection of meaningful storage data. Growers may view and compare trends over time to better understand what leads to key events, progressively improving produce storage.

Next steps

EMILI will continue demonstrating the ability of Smart Storage Monitoring to provide actionable insights on the storage quality of potatoes at Innovation Farms MacGregor.