Seeing Inside the Seed Potato: What Happens During Storage Dormancy

A summary of the Year 2 interim report.

WHY THIS RESEARCH MATTERS TO YOU

Every stored potato is quietly changing. While it sits in the bin, it moves from a resting, dormant state toward sprouting and along the way, starch inside the tuber breaks down into sugars. That shift affects fry colour, seed vigour, and shelf life, but until now, growers and researchers have had no easy way to "see" it happening inside the tuber without cutting it open.

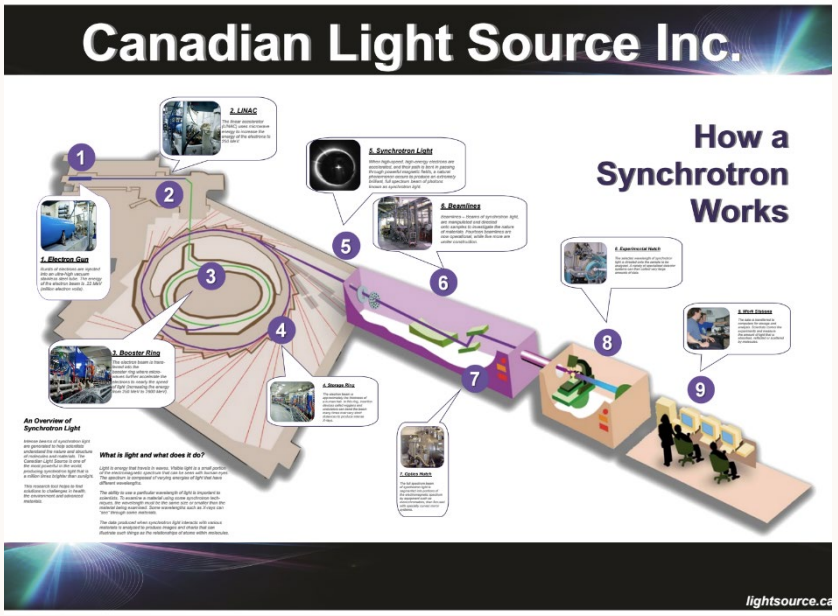
> **The goal:** use powerful imaging and chemistry tools, borrowed from medicine and physics, to map exactly how a potato's internal structure and chemistry change as it breaks dormancy. The long-term payoff for growers is better tools to predict sprouting, protect seed and processing quality, and reduce storage losses.

WHAT THE RESEARCH IS TRYING TO DO

- **1. Track the chemistry:** Measure starch, sugar, protein, and hormone levels in stored tubers over time, in the lab.
- **2. Predict sugar build-up:** Build a camera-based model that can flag rising sugar levels early, without damaging the potato.
- **3. Read molecular signals:** Use chemical "fingerprinting" to catch the earliest molecular signs that dormancy is ending.
- **4. Look inside the tuber:** Use ultra-powerful X-ray and infrared imaging to see internal structure, layer by layer.

THE TOOLS BEHIND THE SCIENCE

- **Hyperspectral imaging (HSI):** A specialized camera that reads light reflected off the potato's surface to detect chemical changes, think of it as a scanner that can see sugar and starch content without touching the tuber.
- **ATR-FTIR spectroscopy:** A chemical fingerprinting method that identifies which molecules (starch, sugar, protein) are present and how they're changing at a very fine scale.
- **Synchrotron X-ray & infrared imaging:** Conducted at the Canadian Light Source in Saskatoon, an enormous, extremely bright light source (like a supercharged microscope) that images the tuber's internal microstructure without cutting into it.
- **Biochemical lab assays:** Traditional lab testing of starch, sugar, protein and hormone levels, used to confirm and calibrate what the imaging tools are detecting.



> **Why combine all four?** No single tool can show the whole picture of dormancy on its own so pairing surface imaging, molecular fingerprinting, and internal X-ray scanning with traditional lab chemistry means each method checks and strengthens the others.

A BUMP IN THE ROAD

The Canadian Light Source's particle accelerator needed replacement and was offline through 2024–25. It's back up and running as of October 2025. The delay pushed the synchrotron work back slightly but did not change the project's goals or expected results.

PROGRESS AT A GLANCE

- **WINTER 2024 - DEC 2024 -** PhD student completed all required coursework with a strong GPA, laying the scientific groundwork for the project.
- **JAN - APR 2025 -** Preliminary trials tested and refined the methods later used in the full-scale experiments.
- **OCT 2025 - APR 2026 -** Full experiments underway on three CFIA-certified seed potato cultivars, stored under commercial conditions (4°C, 95% relative humidity) and sampled every three weeks to track dormancy as it progresses.
- **JAN - JUN 2026 -** Synchrotron imaging sessions completed at the Canadian Light Source; camera-based (hyperspectral) data collection wrapping up by end of April 2026. Chemical fingerprinting and lab testing ongoing.
- **NEXT -** Analyze and compare results across all four methods to build a complete picture of how dormancy unfolds inside the tuber.

WHAT'S NEXT

- **Summer/Fall 2026:** Finish comparing hyperspectral, chemical, and X-ray imaging data to map how tuber composition changes during storage.
- **July 2026:** Present findings at the CSABE/SCGAB engineering conference in Saskatoon.
- **Summer/Fall 2026:** Write thesis chapters and research articles.
- **Early 2027:** PhD thesis defense and final publications.

GETTING THE WORD OUT

Presented at: Potato Research Symposiums, University of Lethbridge (Jan 2025 & Feb 2026); 2025 Alberta Potato Conference, Red Deer.

Published:

- **Keithellakpam, L.B.**; Danielski, R.; Singh, C.B.; Jayas, D.S.; Karunakaran, C. A Comprehensive Review on Minimally Destructive Quality and Safety Assessment of Agri-Food Products: Chemometrics-Coupled Mid-Infrared Spectroscopy. Foods 2025, 14, 3805. https://doi.org/10.3390/foods14223805
- **Keithellakpam, L.B.**; Karunakaran, C.; Singh, C.B.; Jayas, D.S.; Danielski, R. A Comprehensive Review on Pre- and Post-Harvest Perspectives of Potato Quality and Non-Destructive Assessment Approaches. Appl. Sci. 2026, 16, 190. https://doi.org/10.3390/app16010190

BOTTOM LINE FOR GROWERS

> This research is building the science behind future non-destructive tools that could one day help you monitor sprouting risk and storage quality in real time without cutting into a single tuber.

Research project being conducted under Dr. Chrandra Singh at the Lethbridge Polytechnic, funded by Potato Growers of Alberta · Full interim report available on request

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