Visit to the Czech Advanced Technology and Research Institute (CATRIN) as part of the PataFEST project, 18 to 22nd November 2024

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Headline bullet points:

- Major postharvest potato diseases, such as dry rot (*Fusarium sambucinum*), black dot (*Colletotrichum coccodes*), and silver scurf (*Helminthosporium solani*), are caused by soil-borne pathogens that impact both field and storage stages, leading to significant economic losses for farmers and the pre-pack industry.
- Understanding pre- and postharvest factors influencing fungal pathogens is key to developing an integrated disease management approach for staple crops like potatoes, reducing food loss and ensuring food security.
- Chemical pesticides play a crucial role in protecting yields and reducing food waste; however, the EU Green Deal aims to cut fossil-based pesticide use by 50% through the adoption of more sustainable plant health solutions[1].

Background:

The visit took place in the Czech Advanced Technology and Research Institute (CATRIN) facilities belonging to Palacký University in Olomouc, in Czechia.

PataFEST is an innovative initiative focusing on addressing emerging plant health risks and promoting sustainable agriculture. The project aims to enhance potato resilience by developing disease-resistant genes, using real-time diagnostic tools and AI algorithms for early detection, and promoting eco-friendly practices for pest and disease control. Its Integrated Pest Management strategy involves collaboration across Europe and international partners to ensure long-term sustainability in agriculture.

The PataFEST project involves 18 partners across nine countries. One of the key partners, CATRIN, is a leading institution in plant-environment interaction research. Their focus is on understanding plant strategies through morphological, physiological, and biochemical responses to various stress conditions, with the aim of improving resistance and reducing yield losses.

Travel Findings:

CATRIN possesses a state-of-the-art (semi-)automated plant phenotyping facility, Olophen (Figure 1), capable of analysing hundreds of plants in a single run under combined stress conditions using non-invasive, imaging-based approaches[2] for which

[1] European Green Deal. Available here.
[2] De Diego N, Fürst T, Humplík JF, Ugena L, Podlešáková K and Spíchal L (2017). An Automated Method for High-Throughput Screening of *Arabidopsis Rosette* Growth in Multi-Well Plates and Its Validation in Stress Conditions. *Front. Plant Sci.* 8:1702. doi: 10.3389/fpls.2017.01702

they are internationally recognised. This aligns with the main task of one of the Work Packages for the project (WP2: Early detection and surveillance tools), for which they are the task leaders. They are responsible for the initial stages of plant phenotyping using *in vitro* plants, while Cranfield will advance the process to the next stage and validate the trial in a glasshouse setting. One major aspect of the visit was to learn from CATRIN's *in vitro* studies on potato plant phenotyping to be able to define key parameters for our large-scale experiment, optimising the outcomes and ensuring the robustness of the results. The large-scale experiment will be carried out in Cranfield facilities where the effects of extreme climate change scenarios on potato growth, tuber production, and disease severity (i.e., black dot and silver scurf) under controlled glasshouse conditions are going to be tested as part of WP2 mentioned above. Furthermore, CATRIN's expertise and equipment for detecting volatile organic compounds (VOCs) are critical for advancing the work on developing early detection systems for dry rot on potatoes.

Therefore, the purpose of my visit was to spend a week at CATRIN facilities, where I:

- Learned about how Olophen operates, its setup parameters, and the variables under study, which will help scale up these methods at Cranfield University facilities and had the opportunity to discuss the potential experimental design and factors to consider for the trials.
- Focused on evaluating VOC biomarkers emitted by potatoes infected with dry rot caused by *Fusarium sambucinum*, as a key parameter for the early detection of dry rot disease during storage.

Both activities are critical to achieving the project's milestones: providing growers with insights into how climate change might impact crop health and management strategies and developing an early detection system to improve disease management for storage practitioners.

Figure 1.Plant phenotyping facility Olophen in CATRIN

On a practical level, the experiments conducted, and the knowledge acquired during this visit will lead to impactful outcomes for the research. Specifically, our project seeks to: 1) develop strategies to protect potatoes from emerging pests and threats related

to climate change and excessive pesticide use, and 2) define potential biomarkers related to diseases under study which will enable the development of more effective control measures to reduce crop losses. Translating these research findings into practical applications will be a core focus of the project.

Personal Statement:

This visit presented a fantastic opportunity to network and establish connections with project partners, fostering relationships and set the stage for future collaborations. As an independent researcher, it also provided a chance to learn new techniques that can be applied to my work and explore alternative approaches, which are essential for my professional growth and development. A potential and direct output could be the publication of research papers.

Given the growing challenges posed by climate change and the excessive use of pesticides, which have led resistance in soil-borne pathogens and the reappearance of these pathogens, it is essential to develop sustainable and circular solutions for plant health. By studying how climate change can impact disease severity in potato crops, we will be able to provide actionable advice to growers, enabling them to better manage emerging threats. Additionally, when diseases cannot be effectively controlled in the field, alternative control strategies for postharvest cold storage are essential. That is the reason why it is crucial to study both pre- and postharvest factors, ultimately leading to an improved, integrated pest management approach.

In summary, the progress made during this visit is directly contributing to advancing disease management strategies. This will provide valuable insights for growers and storage practitioners, helping reduce crop losses and supporting the UK horticulture sector in adopting more sustainable and effective methods of pest and disease control.

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Acknowledgements: Thanks to CATRIN for hosting this insightful visit, and to The GCRI Trust for the financial support.

Funded by the European Union

Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Research Executive Agency (REA). Neither the European Union nor the granting authority can be held responsible for them.