Agroscope

Molecular detection of cereal pathogens

Starting date: immediately or by agreement

Duration: 6-12 months, depending on degree-awarding institute's requirements

Working Place: Reckenholz Zurich

Language: English/German

Agroscope research group: Molecular Agroecology and Plant Ecology

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Background

Without proper management, seedborne diseases pose a significant threat to cereal crop production in Switzerland and abroad because of their impact yield and food security. Seedborne diseases are especially critical to control in organic and pesticide free production, which requires the use of untreated cereal seeds. Seed health tests provide an effective tool to reduce the risk of certain seedborne diseases, which may become more relied upon in the future if certain active ingredients in seed treatments are no longer allowed.

Ustilago nuda, the causative agent of loose smut of barley, is difficult to detect within the seed because of its location within the embryo. We developed a molecular assay (Panzetti et al. 2025 Scientific Reports) to detect this disease in milled barley seeds and determine the risk associated with seed lots for loose smut. Further experiments are necessary to integrate its use as a preventative strategy against *U. nuda*.

Wheat, a close relative of barley, is infected by *Ustilago tritici,* the causative agent of loose smut of wheat. Like *U. nuda,* this pathogen is difficult to detect, and an analogous molecular method has the potential to effectively detect *U. tritici* infections in wheat seeds.

Objectives

The main objective of the project is to determine the reliability of an established *U. nuda* molecular method in predicting loose smut infection rates across diverse field conditions. With information gathered through molecular testing and field visits, we aim to accurately predict the risk of disease in seed lots. Factors to investigate include differences in results among cultivars and between two vs six row barley varieties. An additional goal is to establish an analogous molecular detection method for *U. tritici*.

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Activities

- Field site visits to assess loose smut in barley and wheat fields
- Molecular work in the laboratory to quantify *U. nuda* DNA with qPCR and to test *U. tritici* detection methods.
- Data visualization and statistical analysis using R
- Thesis writing

Requirements

- Enrollment in master's level studies in environmental sciences, biology, ecology or agricultural sciences.
- Experience in or interest to learn molecular techniques, especially qPCR
- Motivation and interest to work in the laboratory and field

What we provide

- Opportunity to learn molecular techniques and to work in a laboratory environment
- Opportunity to bring own analytical ideas and participate in an applied research project
- Close project supervision by Karen Sullam in coordination with the student's academic supervisor
- Integration into the group of Molecular Agrar and Plant Ecology at Agroscope led by Joëlle Schläpfer