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MSc thesis “Molecular Characterization of Frost Tolerance Genes in Yellow Lupin (*Lupinus luteus*)”

Institut für Züchtungsforschung an landwirtschaftlichen Kulturen in Groß Lüsewitz

The Project

Yellow lupin is a protein-rich grain legume with high agronomic potential, particularly for sustainable cultivation on poor soils in regions with limited water availability. While lupins have primarily been grown as a summer crop, their use as a winter crop is severely limited due to low frost tolerance.

As part of an ongoing research project (PreLuteus, funded by the FNR) and a preceding master's thesis, a high degree of variation in cold tolerance was observed among genetically diverse plant material. Initial gene expression studies using quantitative RT-PCR revealed differential expression of cold stress-related genes between frost-tolerant and frost-sensitive genotypes. In addition, field trials indicated potential yield advantages of winter-hardy genotypes under practical conditions.

Research activities and methods

The planned master's thesis builds upon previous work and aims for molecular characterization of candidate genes associated with cold stress tolerance. The main objectives include:

- Extended gene expression analyses (qRT-PCR) across different tissues and developmental stages
- In-silico analysis of regulatory promoter regions
- Inclusion of additional cold-responsive genes identified from current literature and publicly available databases
- Integration of molecular findings with phenological traits such as plant development, plant height and yield

The results of this work are expected to contribute to a deeper understanding of the genetic mechanisms underlying frost tolerance in lupins. In the long term, these insights may provide a valuable foundation for breeding winter-hardy lupin varieties—an important step toward climate-resilient and sustainable legume production in Central Europe.

Qualification and interest

We are looking for candidates with the following qualification and interest:

- Currently enrolled in a master's program in the field of biological or agricultural sciences, biotechnology, or a closely related discipline.
- Experience on laboratory methods such as nucleic acid extraction, PCR, qRT-PCR, biochemical assays
- Interest in plant stress physiology and gene expression analysis
- Basic knowledge of bioinformatics tools
- Interest of (or exposed to) data collection, statistical analysis and interpretation.
- Competent in written and spoken English.
- Motivation and good work ethics.





Our offer

- a research oriented MSc thesis at the Institute for Breeding Research on Agricultural Crops which is part of the Julius Kühn Institute, the Federal Research Center for Cultivated Plants.
- an international and multi-disciplinary group with expertise on plant breeding, plant genomics and molecular genetics, plant physiology, biostatistics, bioinformatics working on current topics of breeding methodology and crop genetics.
- an enabling working environment and friendly colleagues, state-of-the-art plant cultivation facilities, laboratories and an experimental field.
- Our institute can be reached within 17 minutes by train from Rostock central station.

More information

For further details on project description and application, please contact

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