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Improving adaptability and resilience of perennial ryegrass for safe and sustainable food systems through CRISPR-Cas9 technology - EditGrass4Food

«Edit Grass 4 Food»

Riga, 7th October, 2021

**“EditGrass4Food”, ID No EEA-RESEARCH-64, Contract No EEZ/BPP/VIAA/2021/4
is financially supported by European Economic Area (EEA) grants**

Aim and objectives

Aim of the project is to utilize transcriptomics and functional genomics to increase sustainability in agriculture through improvement of perennial ryegrass with better adaptation to frost and drought for current and future climates.

1. Establish a diverse perennial ryegrass core association panel by utilization of data from ongoing projects (WP1),
2. Screen the association panel in order to detect haplotype-resolved single-nucleotide variants and structural variation in the targeted genes/alleles for freezing and drought genes (WP1),
3. Identify novel genes and characterize drought and freezing tolerance genes by comparing their expression for pathway related genes in non-edited and mutant plants (WP2),
4. Develop CRISPR-Cas9 constructs and generate CRISPR-edited perennial ryegrass mutants for freezing and mild drought tolerance (WP3),
5. Validate and characterize the role of the genes and their sequence variations in the freezing and drought mechanisms (WP4).

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Project partners

- University of Latvia
- Norwegian University of Life Sciences
- Lithuanian Research Centre for Agriculture and Forestry
- Tallinn Technical University



WP1. Establishment and screening of perennial ryegrass association panel for freezing and drought related traits. Coordinator: NMBU; Involved partners: NMBU, LAMMC

WP2. Transcriptome regulation of freezing and drought tolerance in perennial ryegrass. Coordinator: NMBU; Involved partners: NMBU, LAMMC

WP3. Functional characterization of frost and drought candidate genes in perennial ryegrass by CRISPR-Cas9. Coordinator: TalTech; Involved partners: LU, NMBU

WP4. Validation of improved freezing and water shortage tolerance. Coordinator: LAMMC; Involved partners: TalTech, NMBU, LU

WP5. Management and coordination of research activities and dissemination of results. Coordinator: LU; Involved partners: TalTech, NMBU, LAMMC

Deliverables

- **Publications**
4 papers and 1 book chapter (dedicated funding for open access publishing)
- **Project meetings:**
kick-off meeting (2021, Latvia), annual meeting (2022 in Estonia), workshop (2023, Lithuania), final conference (2024, Latvia)
- **Scientific achievements**
association mapping panel, transcriptome sequences, 10 gene edited plants assessed for drought tolerance, 4 PhD students
- **Joint application for Horizon Europe funding**
- **Project interim/final reports – June 2022, June 2023, May 2024**

Scientific topics for discussion

- Association panel
- Reference genome
- Transcriptome sequencing
- Functional characterization – protoplast assays, Agrobacterium transformation of embryogenic calli
- Four candidate genes for freezing and drought related traits
- Drought tolerance of 10 gene-edited plants