Red clover

Author(s):
Vleugels, Tim; Kölliker, Roland

Publication date:
2025

Permanent link:
https://doi.org/https://doi.org/10.3929/ethz-c-000791297

Funding acknowledgement:
- Breeding European Legumes for Increased Sustainability ()

Red clover

Leader name : Tim Vleugels & Roland Kölliker

Contact details: tim.vleugels@ilvo.vlaanderen.be & roland.koelliker@usys.ethz.ch

BELIS
Breeding European Legumes

WP3 – Task 3.1:Protocols to estimate forage and seed yield

- Estimate clover content in grass-clover mixtures using UAV (M1-M48) (**DLF, NMBU**)
  - Year 1-2: Data was collected on grass-clover mixtures in Denmark and Czech Republic (**DLF**)
  - Year 3: Initiate image analysis with data from 2025 (**NMBU** in cooperation with **Agroscope**)
  - Challenges: Clarify IP property rights

- Genetic variation for floret fertility (M1-M48) (**AU**)
  - Year 1-2: Relevant set of varieties established. Experiment ongoing in plastic tunnels on plants from 5 varieties.
  - Year 3: Results expected next winter.

- Method to estimate flower head numbers in seed yield trials: mini-plots and rows (M1-M48) (**EV-ILVO, DSV**, **DLF**, **Agroscope**)
  - Year 1-2: UAV protocol was established. Eight seed yield trials were established (2 at **DSV**, 2 at **DLF**, 3 at **Agroscope,** 1 at **EV-ILVO**). Data collection started in 2025 (UAV images, seed yield data and flower head counts).
  - Year 3: Additional data will be collected in 2026. Model development is planned for 2026 (**EV-ILVO**).
  - Challenges: Modelling work will be performed by a new colleague at **EV-ILVO**

WP3 – Task 3.2: Protocols for disease resistance

- Screening protocols for *Hypera* and *Protapion* insect pest resistance (M1-M36) (**AU**)
  - Year 1-2: Relevant set of varieties established. Experiment started in 2025 with plants from 20 varieties.
  - Year 3: Results expected next winter.

- Screening protocol for powdery mildew resistance (M1-M36) (**CER, EV-ILVO**)
  - Year 1-2: Isolates were collected. Biotests were developed on detached leaves (**CER**) and live plants (**EV-ILVO**). Long-term storage of powdery mildew is under study.
  - Year 3: Finalize bio-tests and assess correlation with field infection.







WP4: Phenotyping and genotyping collections and research populations

- Screen a relevant collection of accessions for resistance to *Fusarium* (M1-M48) (**IKBKS**)
  - Year 1-2: A relevant set of 124 accessions was defined. Two bio-tests, the 'seed inoculation method' and the 'leaf inoculation method' were optimized. Screening of accessions with the seed inoculation method has started and is planned to finish in 2025.
  - Year 3: Accessions will be screened with the leaf inoculation method. A subset of accessions will be defined to be screened in the greenhouse.

- Develop KASP markers linked to freezing tolerance, southern anthracnose and clover rot (M1-M48) (**ETHZ, Agroscope, DSV, NMBU, EV-ILVO**)
  - Year 1-2: Candidate SNPs for KASP marker design were selected. Genotyping was successful for 4 SNPs for freezing tolerance, 10 SNPs for anthracnose resistance and 6 SNPs for clover rot using KASP maker technology at LGC. KASP marker validation will be done in WP5
  - Year 3: No further activities

WP5: Proof of concepts

- Validation of KASP markers for freezing tolerance, southern anthracnose and clover rot (M1-M60) (**ETHZ, Agroscope, DSV, NMBU, EV-ILVO**).
  - Year 1-2: Validation sets were screened for freezing tolerance (**NMBU**), anthracnose (**Agroscope, DSV**) and clover rot (**EV-ILVO**). Genotypes with contrasting stress response were screened with KASP markers (**ETHZ**). Results were processed and various linkages were found.
  - Year 3: Sequencing the genomic region around a promising anthracnose marker (**Agroscope, ETHZ**). Publish results.
  - Challenges: SNPs identified by GWAS may be too far from causal genes to be useful in marker-assisted selection.

- Evaluate UAV methodology to estimate forage yield in practical breeding programs (M1-M60) (**DLF, DSV, EV-ILVO**)
  - Year 1-2: UAV protocol was established. Data collection (yield data and UAV images) started in 2025 with 2 trials at **DLF**, 2 trials at **DSV**, 1 at **EV-ILVO**.
  - Year 3: Collect additional yield and UAV data. Initiate model development (**EV-ILVO**).
  - Challenges: Allocating time to perform the UAV work at the breeding stations (**DSV, DLF**). Modelling will be performed by a new colleague at **EV-ILVO**.

- Inventory of existing phenotypic and genotypic tools and protocols (**all partners**) (M1-M48).
  - Year 1-2: No activities
  - year 3: Protocols that are finished and validates will be added to the inventory
  - Challenges: Use the trait onthology for all traits.

Funded by
the European Union