Field trial with transgenic poplar downregulated for *CAFFEOYL SHIKIMATE ESTERASE*, a gene involved in lignification

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BACKGROUND

- The current energy sources are mainly petroleum-based matrices and **lignocellulosic plant biomass** is a good alternative as a feedstock for the production of carbon-neutral energy.

- The polysaccharides in the plant cell walls can be converted into fermentable sugars for biofuel production. However, **the presence of the cell wall polymer lignin hinders the process of polysaccharide conversion.**

- Genetic modification of plants for genes involved in lignin biosynthesis has been used to generate plants with **altered lignin levels and composition**, and improved sugar release upon biomass saccharification.

- **CAFFEOYL SHIKIMATE ESTERASE (CSE)** plays an essential role in monolignol biosynthesis catalyzing the conversion of caffeoyl shikimate into caffeate.

- Greenhouse-grown ***Populus tremula* x *P. alba* downregulated *hpCSE*** had:
  - reduction in the lignin amount (up to 25%)
  - no biomass yield penalty
  - improved biomass saccharification

- The goal of this research is to evaluate how downregulated *hpCSE* hybrid poplar lines cope with environmental conditions and whether these **field-grown plants** present favorable biomass traits for biorefining.

One-year-old field trial of *hpCSE* poplars in Flanders, Belgium.

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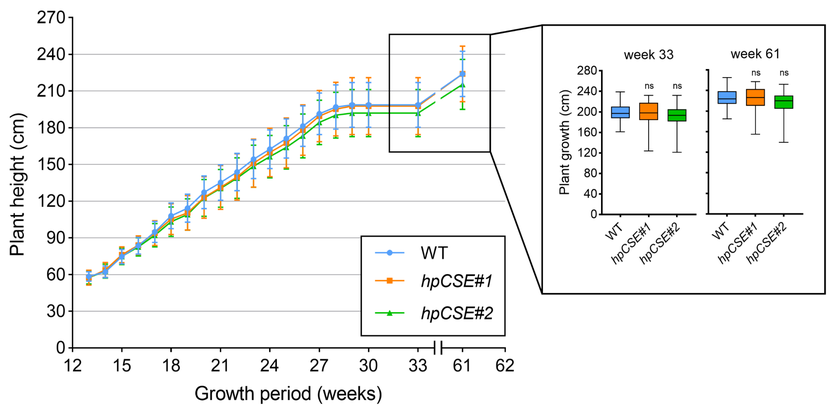
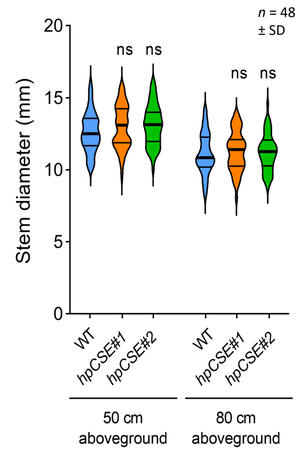
RESULTS

Plant growth from the first growth cycle



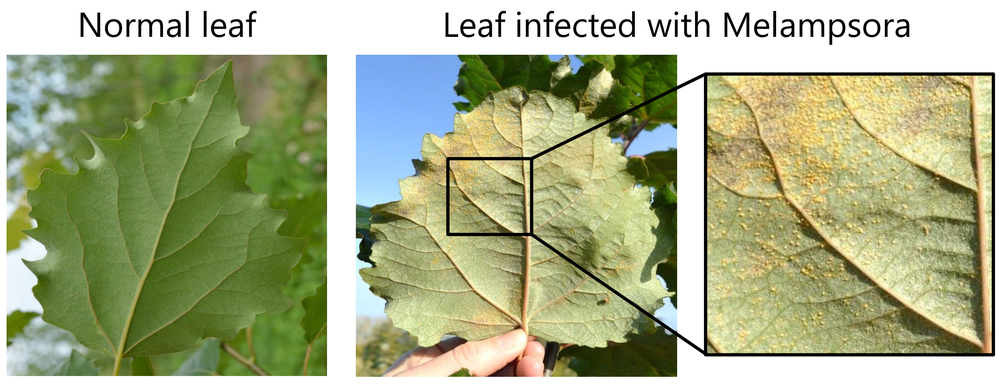
Stem diameter



Downregulation of *CSE* does not affect plant growth or stem diameter in the first growth cycle of *Populus tremula* x *P. alba* in the field trial.

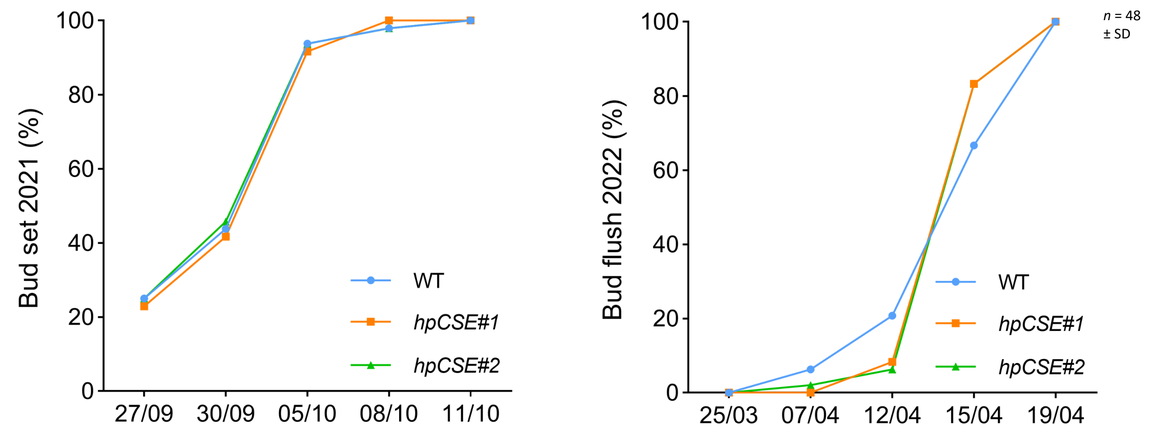
Rust infection and insect damage in the trees

Genotype	Rust score	Insect damage
WT	1.14 ± 0.29	1.06 ± 0.43
hpCSE#1	1.03 ± 0.33 (n.s.)	0.94 ± 0.52 (n.s.)
hpCSE#2	1.10 ± 0.41 (n.s.)	1.04 ± 0.61 (n.s.)



Downregulation of *CSE* has no effect on the rust and herbivorous insect susceptibility of field-grown poplars.

Bud set (autumn 2021) and bud flush (spring 2022)



One-year-old *hpCSE* poplars displayed bud set and bud flush similarly to the WT in the field trial.

CONCLUSIONS & FUTURE PERSPECTIVES

- Field-grown *hpCSE* poplars displayed no differences in plant growth or stem diameter. Also, no shifts in rust infection, insect damage, bud set and bud flush were observed in the first growth cycle.
  - Considering these data, *hpCSE* poplars are a promising biomass feedstock for biorefining.

- The first harvest of the field trial will be in the end of the second growth cycle (winter 2023) followed by biomass characterization.

REFERENCES

1 Vanholme *et al.* (2013)
2. Saleme *et al.* (2017)

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