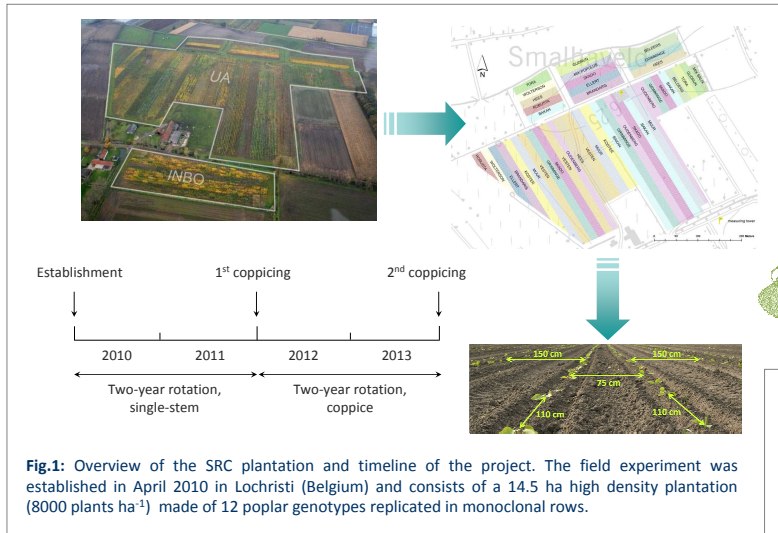
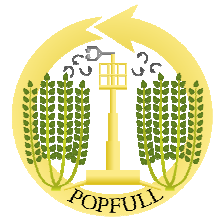


WATER USE EFFICIENCY AND WATER BALANCE OF A POPLAR BIO-ENERGY PLANTATION

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➤ UNDERSTANDING THE INTERACTIONS BETWEEN WATER AND CARBON FLUXES IN AN OPERATIONAL POPLAR SHORT ROTATION COPPICE (SRC) CULTURE DEDICATED TO BIO-ENERGY PRODUCTION

- Assess the **efficiency with which water is used to fix carbon and produce biomass at different scales**
- Assess the whole water consumption of the poplar SRC plantation and quantify its impact on the site water balance

Leaf scale

Plant scale

Ecosystem scale

➤ **WATER-USE EFFICIENCY (WUE) AS AN INTEGRATIVE TRAIT LINKING CARBON AND WATER FLUXES**

$$WUE = \frac{\text{rate of C uptake or biomass production}}{\text{water loss}}$$

Defined as such, the concept of WUE can be applied at different time and spatial scales, all relevant.

Plant scale

Ecosystem scale

- **Upscaling individual tree data to the whole plantation**
- **Measuring above-canopy fluxes through eddy covariance**

➤ ONGOING AND FORECASTED MEASUREMENTS

- **Leaf gas exchange under saturating conditions**
+ **Physiological drivers** (photosynthetic parameters from A-C_i and light curves, fluorescence)
- **Leaf gas exchange under ambient conditions – Diurnal variations**
+ **Environmental drivers** (sensitivity of stomatal conductance to light, VPD and daily hysteresis)
- **Bulk leaf ¹³C and ¹⁸O isotopic composition (δ¹³C and δ¹⁸O)**
+ **Validating WUE_i ∝ δ¹³C** (Farquhar's model)
- **Sap flow measurements (tree transpiration) and continuous radial growth monitoring (biomass accumulation)**
- **δ¹³C and δ¹⁸O of phloem sap and wood**

➤ EXPECTED OUTCOMES

- ✓ BETTER UNDERSTANDING OF PHYSIOLOGICAL AND ENVIRONMENTAL FACTORS DRIVING CARBON AND WATER FLUXES AT EACH STUDY SCALE
- ✓ GENOTYPIC AND TEMPORAL VARIATIONS OF WUE AND OF RELATIVE PHOTOSYNTHETIC LIMITATIONS (BIOCHEMISTRY, MESOPHYLL AND STOMATAL)
- ✓ UPSCALING EFFORT TO ASSESS THE RELIABILITY OF INTER-RELATIONSHIPS BETWEEN WUE ESTIMATORS OVER THE DIFFERENT INTEGRATION SCALES

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