# Miscanthus even more beneficial for the environment: validation of key variables for nitrogen recycling in *Miscanthus sinensis* and QTL detection

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## Introduction

- Miscanthus is a **perennial** grass that belongs to family Poaceae. It produces **biomass** directly valued for the bioeconomy.
- It also provides **ecological services** (carbon sequestration, water and soil protection).
- An important trait of miscanthus is its ability to efficiently recycle nutrients, especially nitrogen. My PhD research is focused on studying biomass production in relation with nitrogen recycling in miscanthus.

**Biomass production**

High biomass production making it an ecological alternative as a source of renewable energy (Arnoult at al., 2015)

**Nitrogen recycling**

Allows it to have low fertilization needs (Cadoux et al., 2012)

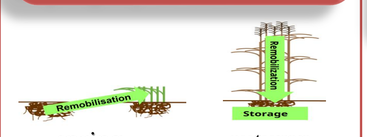
and limits the environmental impact (Cadoux et al., 2014)


## Objective

### Dual objective of my thesis

**Ecophysiology**

**Characterize phenotypic variability of spring and autumn remobilizations in progeny of *M. sinensis***




spring remobilization (SR) — autumn remobilization (AR)

**Facilitate phenotyping by identifying and validating indirect measures of variables**

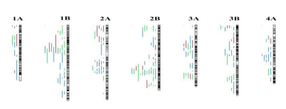
stem nitrogen content = indicator of recycling?

**Genetics**

**Extent of genetic variability for observed remobilizations (strong or weak heritability, etc.)?**

80 genotypes
1088 miscanthus plants

**Can we identify the chromosomal regions involved?**



QTL detection using established methods

- A sterile interspecific hybrid ***Miscanthus* × *giganteus*** represents most of the miscanthus biomass grown in Europe.
- The fact that a single genetic background of *Miscanthus* × *giganteus* is mainly grown in France, can present a risk in the slight event of climatic or phytosanitary hazards.
- Hence, we need to diversify the varietal offer. ⚠
- ***Miscanthus sinensis*** is a very good alternative:


**Huge genetic variability** (Sun et al., 2010)

**Phytoremediation activity** (Nurzhanova et al., 2017)

**Better abiotic stress tolerance** (Lewandowski et al., 2016)

**Intraspecific variability** (Zub H and Brancourt-Hulmel M., 2010)

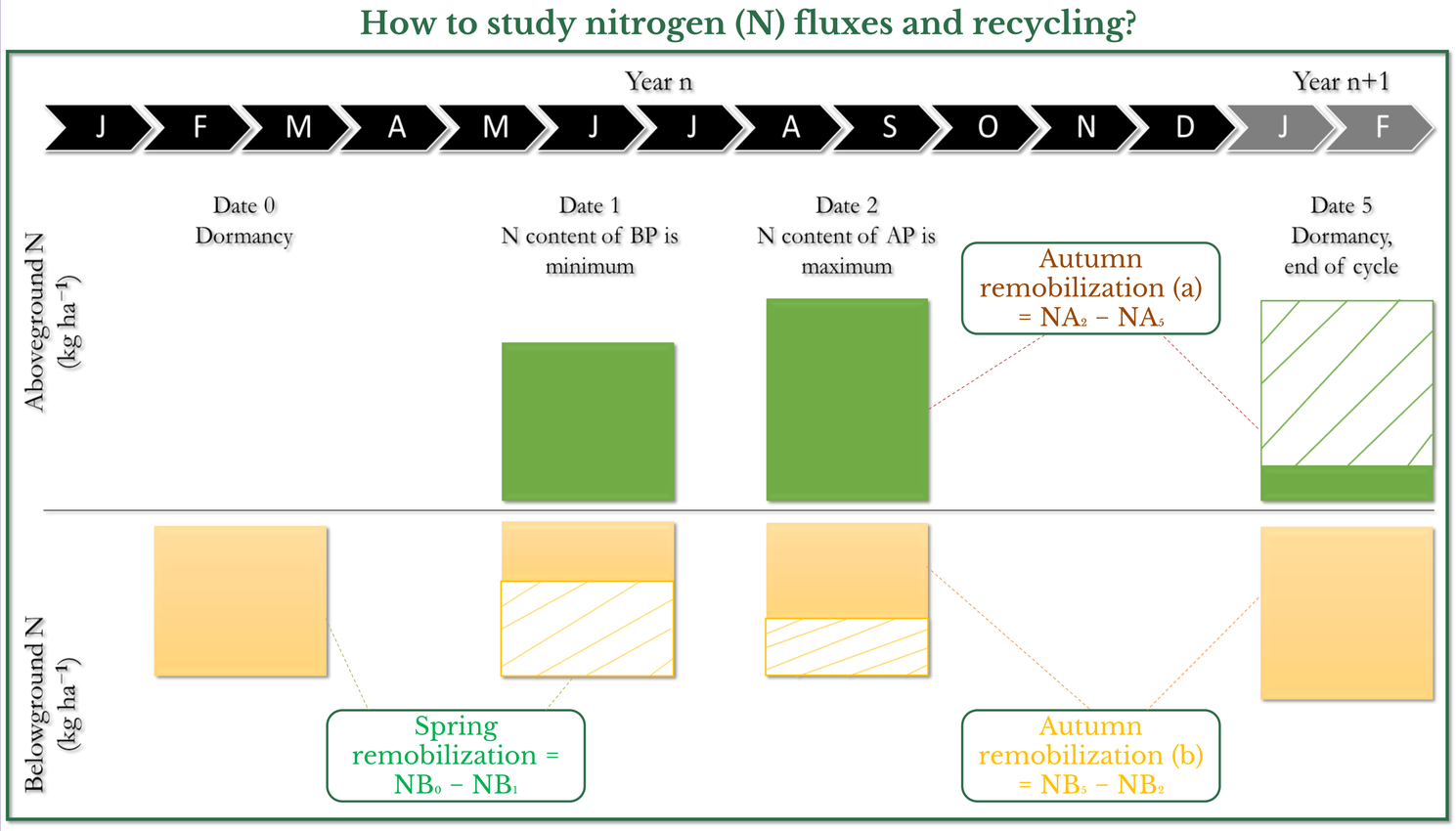
**Able to recycle nitrogen as efficiently as *M. x giganteus*** (Leroy et al. 2022)

### Identifying indirect measurement variables of recycling

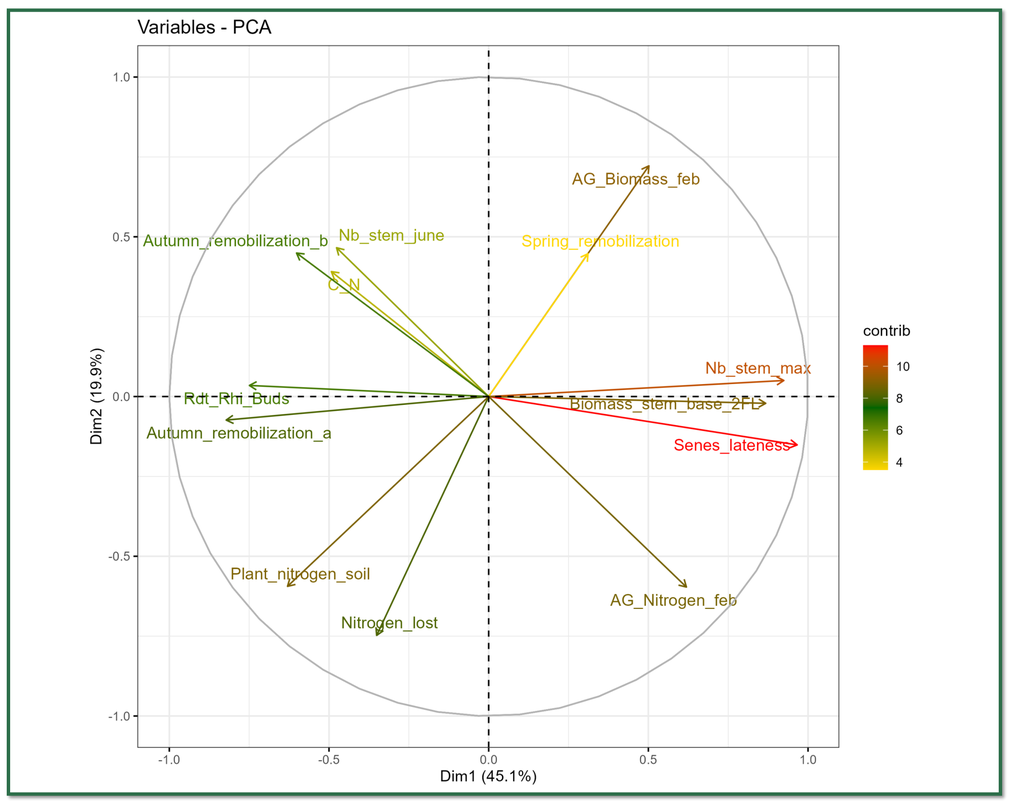
- The goal is to identify easy-to-measure and non-destructive traits for breeders which can be used as indirect measurement variables (indicators) of nitrogen recycling.
- We have identified several such indicators and will further validate them this year.

## Methodology and results

### How to study nitrogen (N) fluxes and recycling?




- To study nitrogen recycling, we have to collect above-ground parts (AP) and below-ground parts (BP) of the plants at different key dates and analyze the changes in nitrogen content over a given period (remobilization).
- Spring remobilization (SR, kg N ha−1): transfer of nutrients from below-ground parts to new buds and stems at the beginning of the growing season.
- Autumn remobilization (AR, kg N ha−1): downward transfer of nutrients from above-ground parts (leaves and stems) for storage in the rhizome during senescence.




- **Correlations of autumn and spring remobilizations with various traits:**

**Autumn remobilization (a)**

Biomass from the 4cm rhizome of the buds (Rdt_Rhi_Buds) +0.67

**Nb_stem_june** +0.4

**AG_Biomass_feb** -0.41

**AG_Nitrogen_feb** -0.47

**Nb_stem_max** -0.7

**Senes_lateness** -0.83

**Autumn remobilization (b)**

C_N +0.68

**Nb_stem_june** +0.33

**AG_Nitrogen_feb** -0.54

**Senes_lateness** -0.58

Biomass from the base of stem with at least 2 ligulated leaves -0.63

**Nb_stem_max** -0.67

**Spring remobilization**

**AG_Biomass_feb** +0.28

**Senes_lateness** +0.28

Plant_nitrogen_soil -0.48

Biomass from the 4cm rhizome of the buds (Rdt_Rhi_Buds) -0.5

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*BAP, Young Researchers days, April 03 to 05, Clermont-Ferrand, France*

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