



Manuel Derrien, **Séverine Monnot**, Maryse Brancourt-Hulmel
Cross-border joint research unit BioEcoAgro

INTRODUCTION

Miscanthus sinensis is a **perennial, undomesticated** species originating from Eastern Asia. As the stem is annually harvested the plant is **pseudo-annual** for the aboveground part. It is one of the parents of the highly productive interspecific hybrid ***Miscanthus x giganteus***. This is a very low-input crop that can produce **10-15 DMt/ha per year**. Management over the following 20 years is minimal: one harvest per year, no irrigation, no fertilization, no fungicide and only herbicides during crop establishment. For this reason, it is considered a model plant for the improvement of **ecosystem services (provisioning, regulating, maintenance, and cultural)**.

Sterile panicles*

- Prevent invasiveness
- Ornamental

* *M. sinensis* is usually fertile (2x or 4x) but tolerates different ploidy levels, which enables the breeding of 3x sterile varieties.

Permanent mulch of dead leaves

- Prevents weed growth from year 2
- Restores carbon to soil
- Phytostabilises heavy metals

Preserved underground water quality

No inputs required:

- No nitrate or chemical leaching
- Suitable for water catchment area
- Productive use of marginal soils



Multi-use biomass

In field

- Biodiversity habitats
- Natural windbreak
- Albedo regulation
- Prevents pesticide drift
- Ornamental

When harvested dried

- Animal bedding
- Horticultural mulch
- Heating
- Biofuels

Non-spreading rhizome

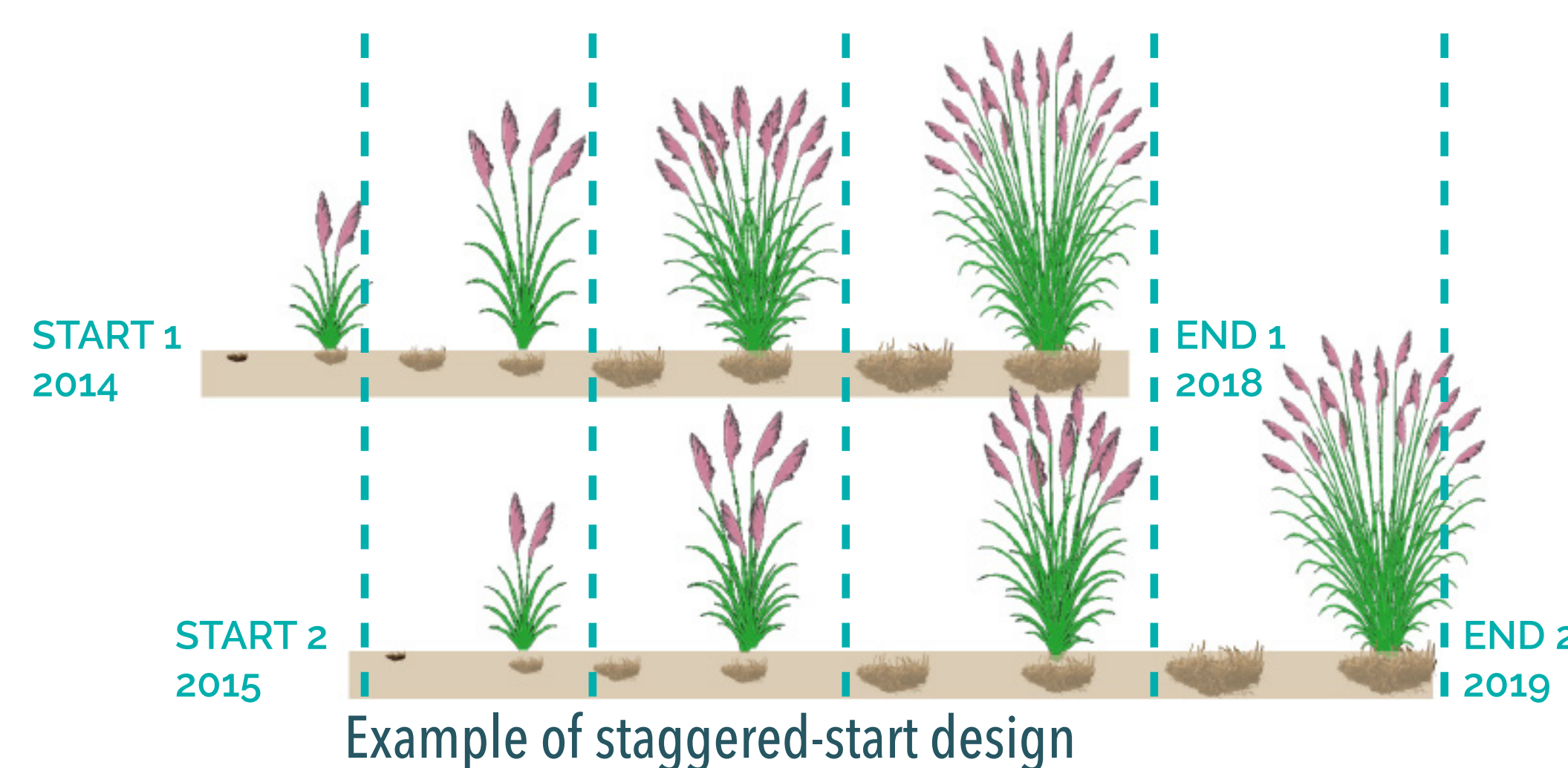
- Prevents invasiveness
- Nitrogen uptake and remobilization
- Prevents soil erosion
- Phytostabilises heavy metals
- Multiplication through propagation**

** Therefore, parental fixation is unnecessary, and the F1 progeny can be directly used in subsequent crosses. **F1 full-sib populations are segregating.**

**MISCANTHUS SINENSIS TAKES UP TO FOUR YEARS TO REACH ITS YIELD PLATEAU.
HOW AND WHEN SHOULD GENOMIC SELECTION BE IMPLEMENTED TO ACCELERATE GENETIC GAIN?**

MATERIALS & METHODS

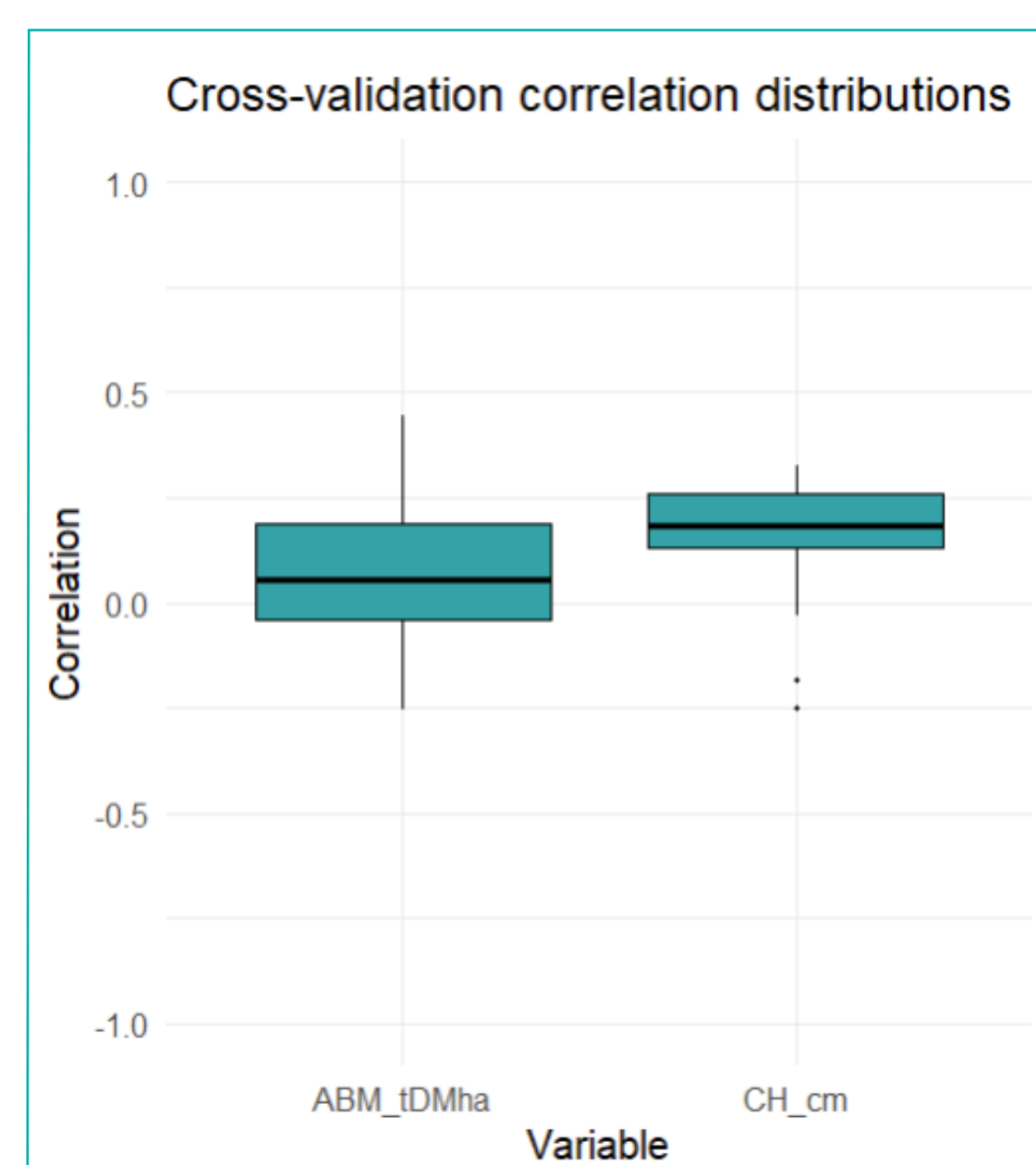
- 155 F1s from a cross between two varieties segregating for yield component traits.
- Two staggered-start designs in two sites to separate environmental effect from age effect.
- 14k SNPs markers (segregation ratios of 1:1, 1:3 and 3:1).
- Single-Step GBLUP model integrating factors including age, site, environment, and spline functions to account for spatial effect.
- Estimation of adult phenotype projection by adding to the training set the juvenile data of the validation population to predict (= to project) the genetic value at adult stage



RESULTS • Objective: predict genetic value at age 4

Naive prediction

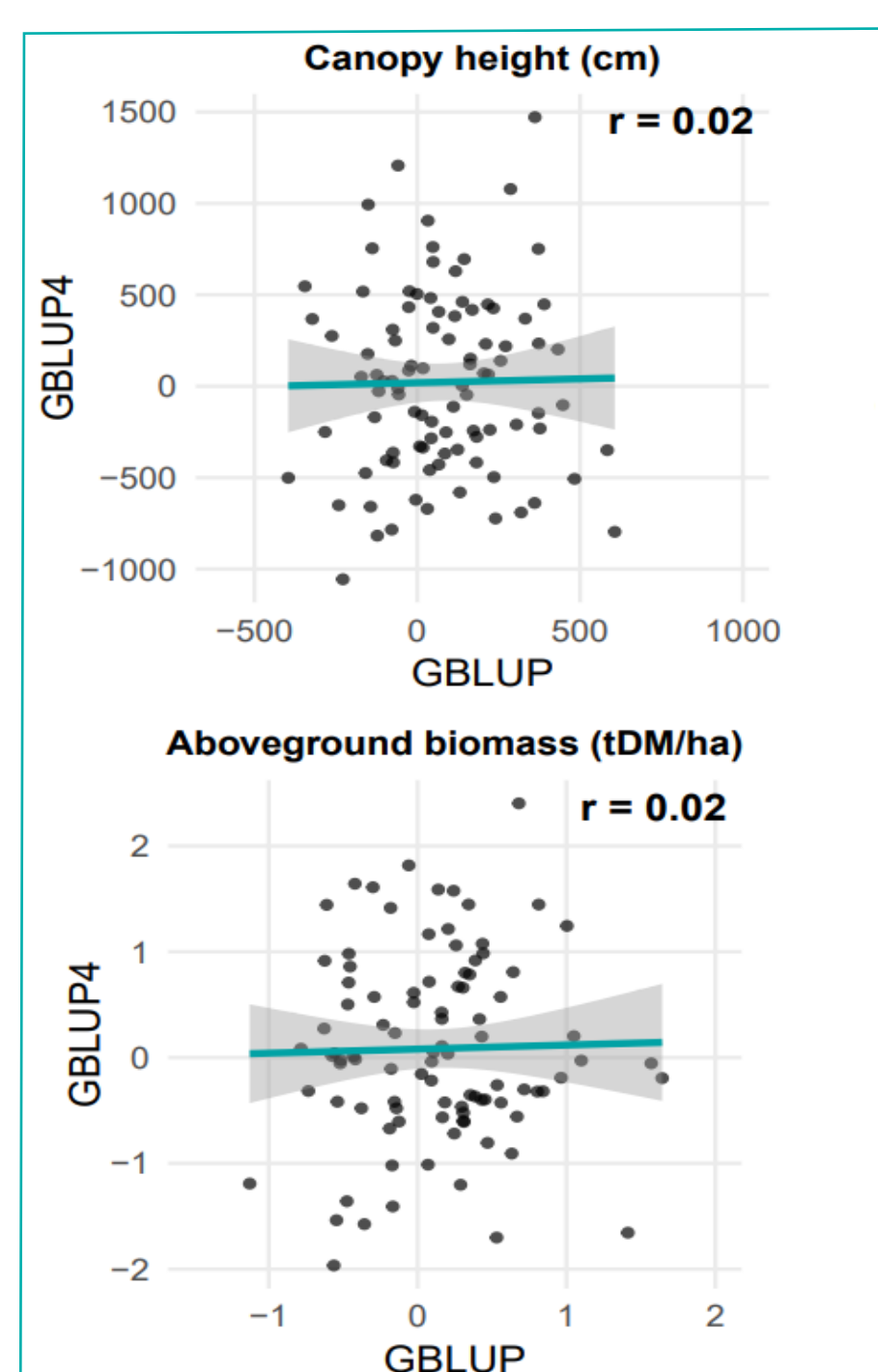
Random TP, 4 years data • 5 folds



TP = Training population CH = Canopy height
VP = Validation population ABM = Aboveground biomass

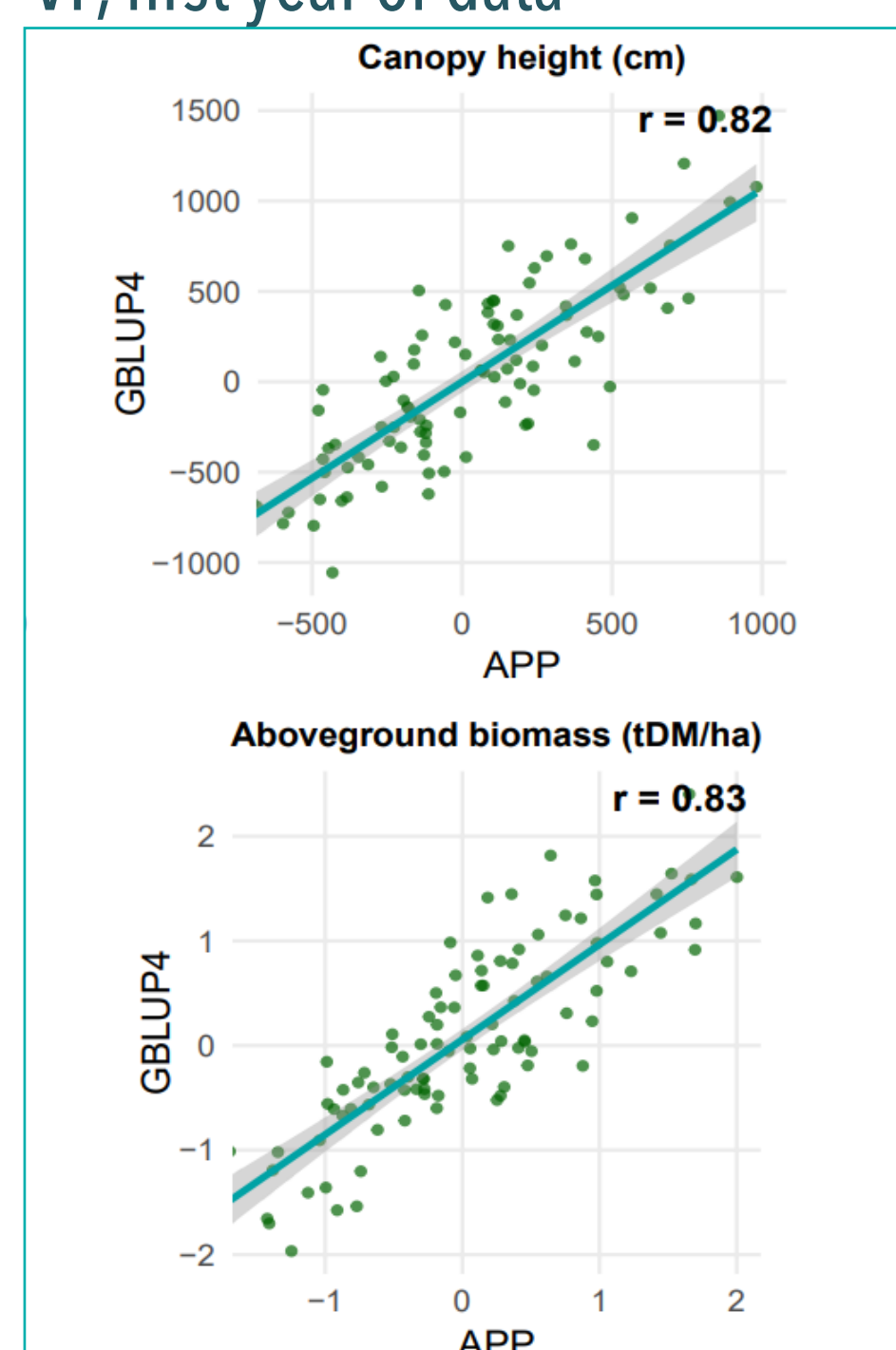
Directed prediction

Selected TP, 4 years of data



Adult phenotype projection (APP)

Selected TP, 4 years of data
+ VP, first year of data



TO BE CONTINUED...

1. Predictions based solely on genetic data **are not accurate enough yet.**
2. Adult phenotype projections are promising **to reduce the breeding cycle from four years to one year.**
3. Predict phenotypes in a **half-sib population** that was also phenotyped for provisioning services traits.
4. Test predictions for regulating services such as nitrate remobilization.
5. Simulate phenotypic variance in full-sib populations

