Seasonal partitioning of dry matter and nitrogen of a model perennial grain, *Thinopyrum intermedium*

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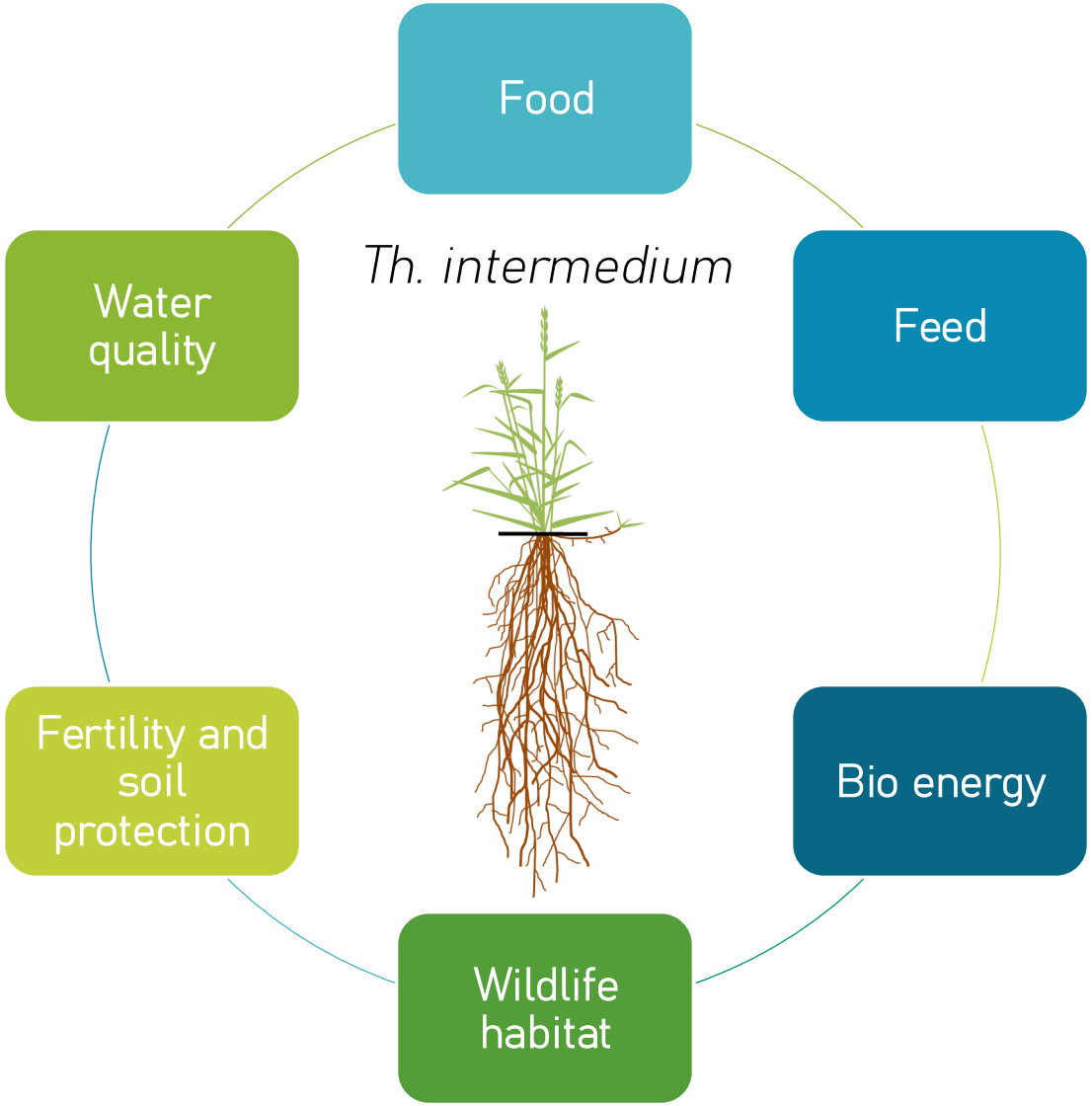
Introduction

- Newly developed **perennial cereal crop known under the trade name Kernza ®** (DeHaan *et al.*, 2018)
  - Perenniality → Ecosystem services
  - Dual production → Grain and forage



Introduction

- Perenniality induces :
  - Low and variable ressource allocation to grains

    (Culman *et al.*, 2013; Newell & Hayes, 2017; Zhang *et al.*, 2015).

  - Large ressource allocation to belowground organs (short rhizomes, deep root system)

    (Ogle *et al.*, 2011; Sainju *et al.*, 2017; Sakiroglu *et al.*, 2020; Sprunger *et al.*, 2018).

  - Better soil exploration and resource use (Culman *et al.*, 2013; Duchene *et al.*, 2020; Jungers *et al.*, 2019).
    - Deep and extensive root system
    - Extended growing period

Introduction

Lack of knowledge regarding dry matter and nitrogen allocation to organs across multiple years of development.

→ Important to enhance breeding strategies and crop management to achieve better yields

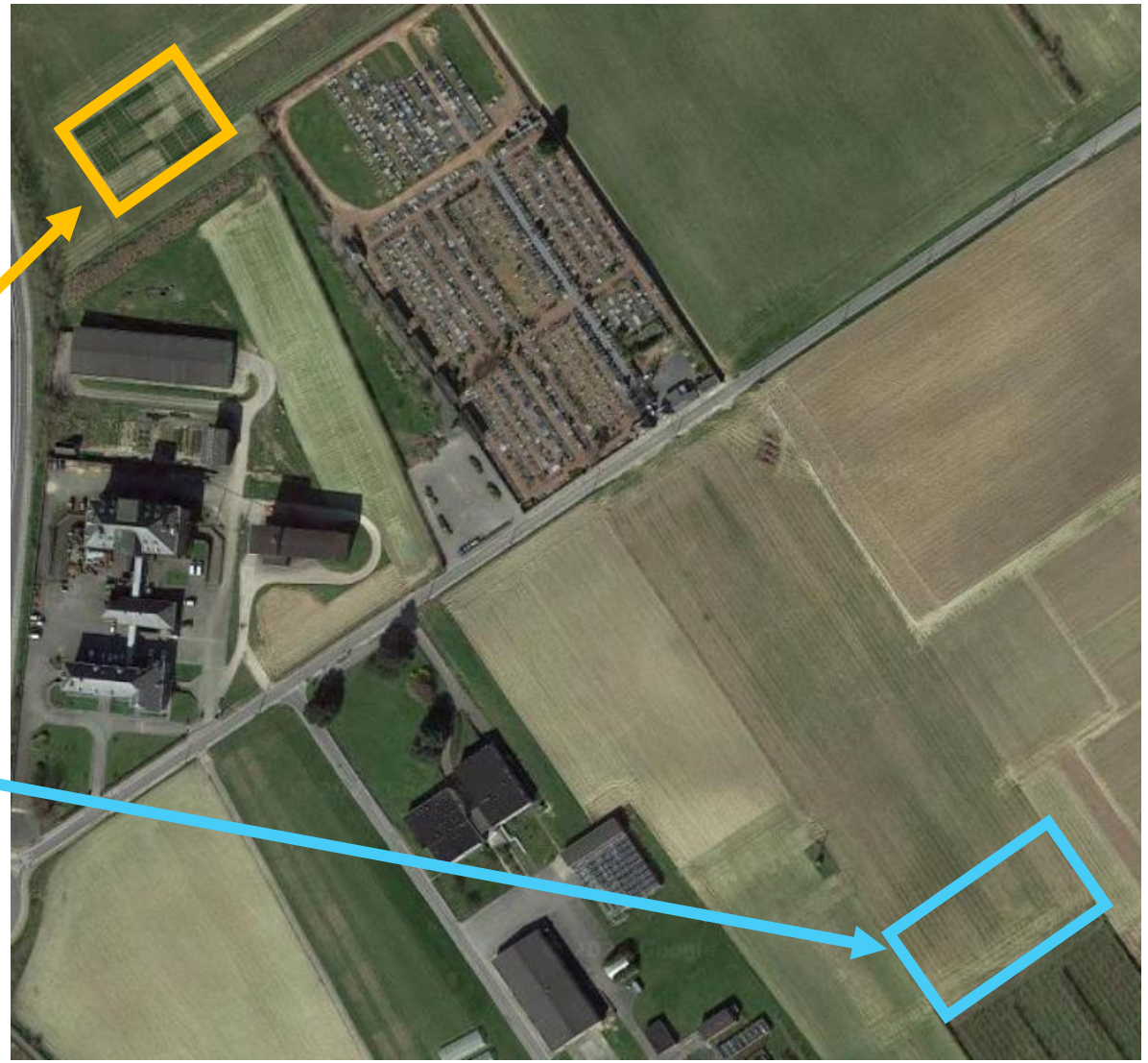
Material & Method

- Two experimental sites

  BE 2 : Third and fourth cropping year

  BE 1 : First and second cropping year

- Two years of data collection: 2022 & 2023



Material & Method

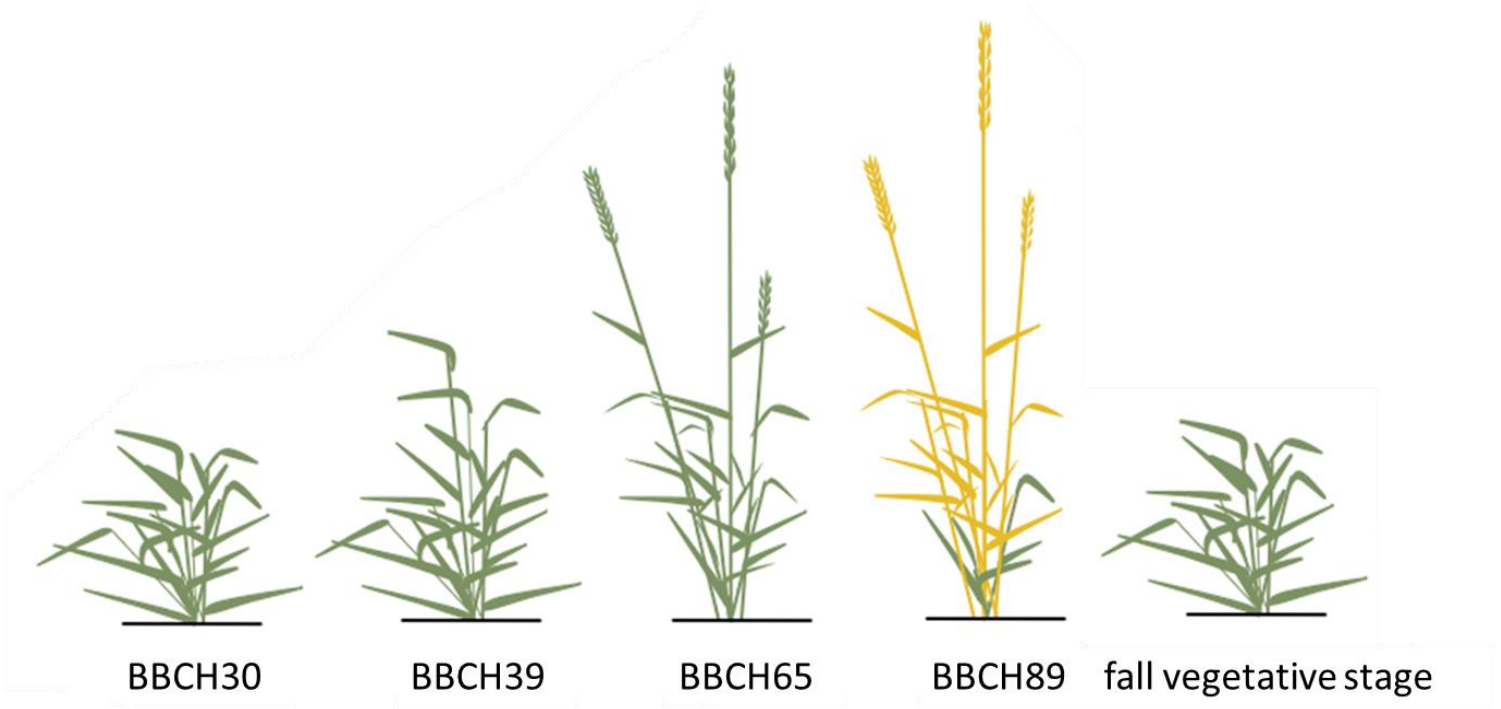
Collect of :

- Leaves, stems, spikes
- Stem bases
- Roots, rhizomes

Fagnant et al., in prep.

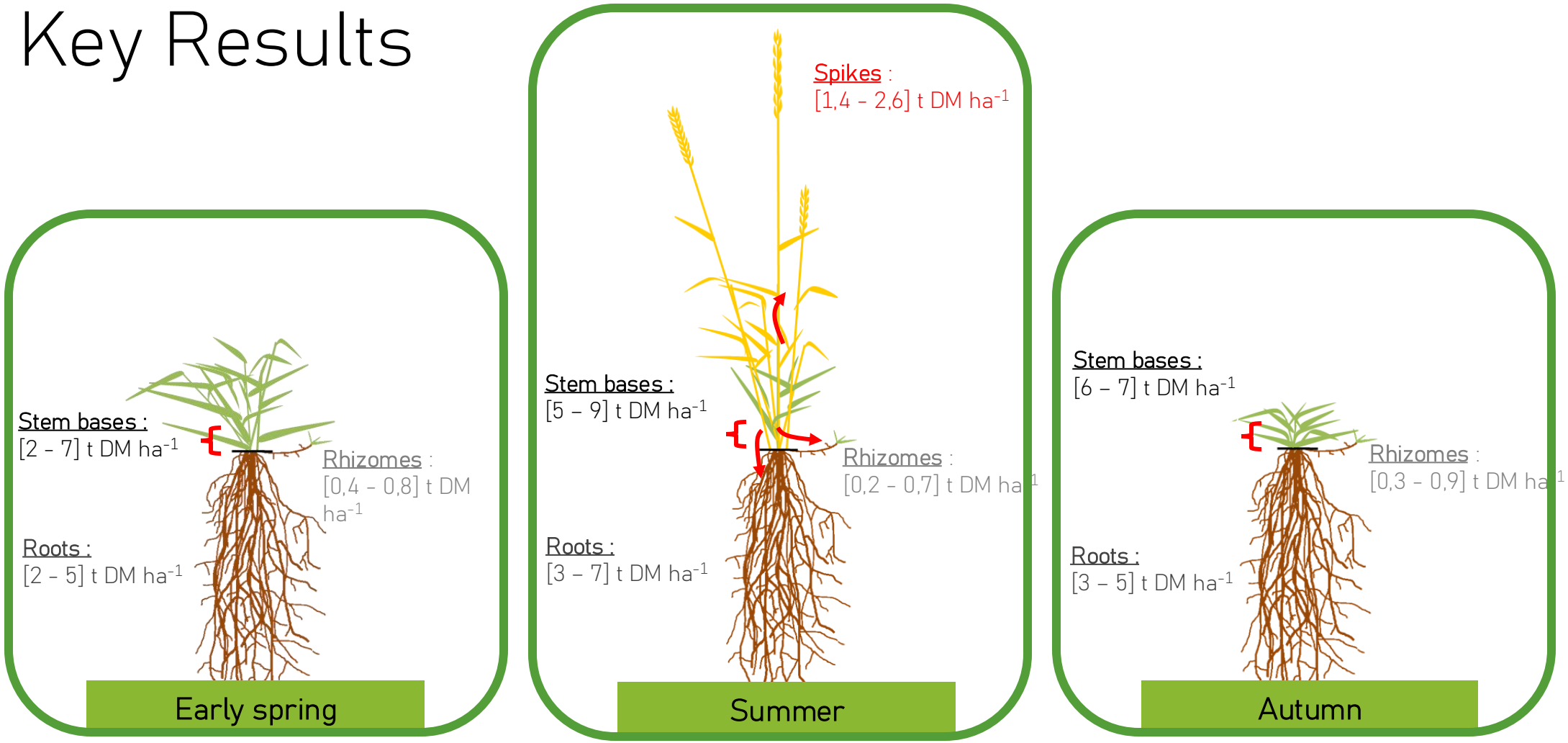
Material & Method

Five development stages



Fagnant et al., in prep.

Key Results



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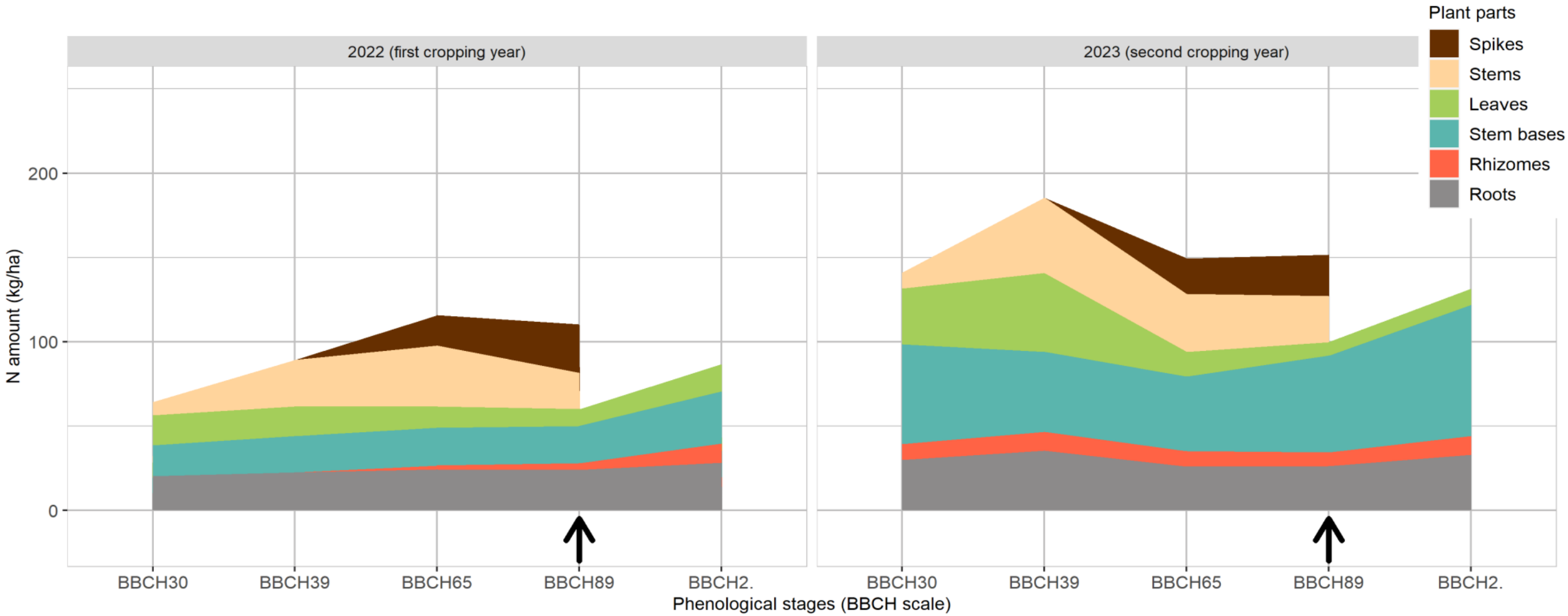
Key Results


Plant parts
Spikes
Stems
Leaves
Stem bases
Rhizomes
Roots
2022 (first cropping year)
2023 (second cropping year)
N amount (kg/ha)
200
100
0
BBCH30
BBCH39
BBCH65
BBCH89
BBCH2.
Phenological stages (BBCH scale)

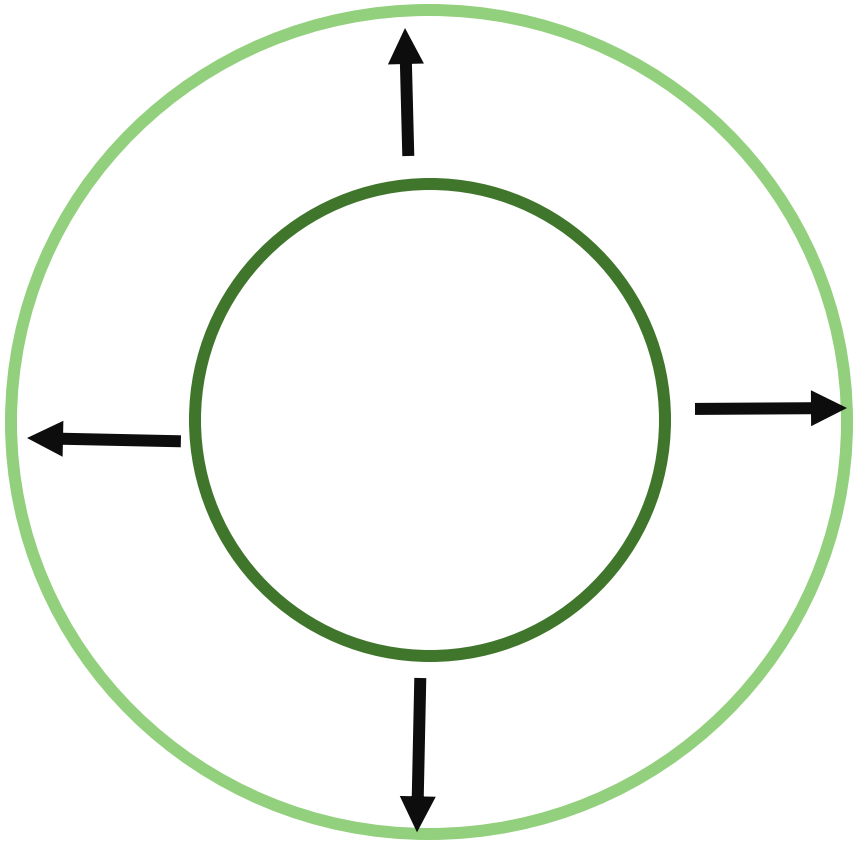
Key Results

- Cespitose grass

  Mainly 'Phalanx' growth strategy

  Slow and radial clonal growth

- Compromise between vegetative and reproductive growth

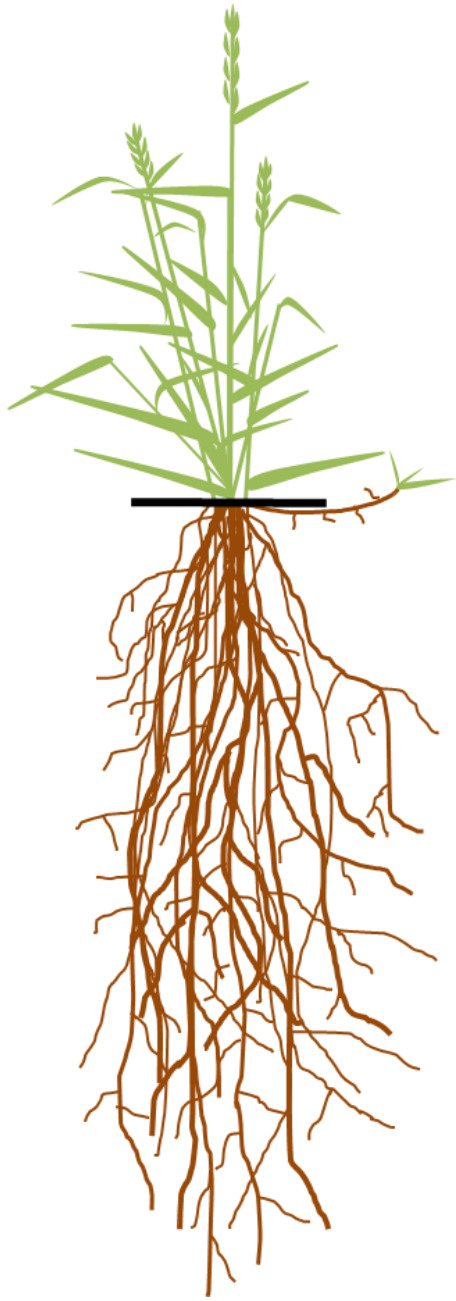


Fagnant et al., in prep.

Discussion

- Cespitose grass :
  - Majority of intravaginal tillers
  - Extravaginal tillers (rhizomes)
  - => Potentially better use of locally abundant ressources (Bam et al., 2023)

- Variability of rhizomes' production
  - ↗ under low intraspecific competiton



Fagnant et al., in prep.

Discussion

Compromise between reproductive and vegetative growth

- ↗ of N within stem bases after the flowering stage
- Stable N within spikes after the flowering stage
- ↘ of grain yield when ↗ stem bases DM

Discussion

- Low N exportation at grain maturity
- Decrease of the total N amount within the plant in the second part of the growing season
  - Root turnover
  - Rhizodepostion

Conclusions

- Long-term survival strategy relies on
  - Weak resource allocation to seeds and sexual reproduction
  - Important investment in perennial basal and belowground organs (Stem bases) = clonal reproduction

→ Implications for breeders : need for selection to increase sink strength of grains

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THANKS FOR YOUR ATTENTION

QUESTIONS ?

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