EFFECT OF FLORAL INDUCTION DURATION ON HEADING DATE AND MORPHOGENESIS IN Lolium perenne

Jean-Louis Durand, Romain Barillot, Simon Rouet

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Jean-Louis Durand[1], Romain Barillot[1] and Simon Rouet[1,*]



[1] Unité de Recherches Pluridisciplinaire Prairie et Plantes Fourragères

Introduction

1. Plant phenology is important and it is changing along with climate

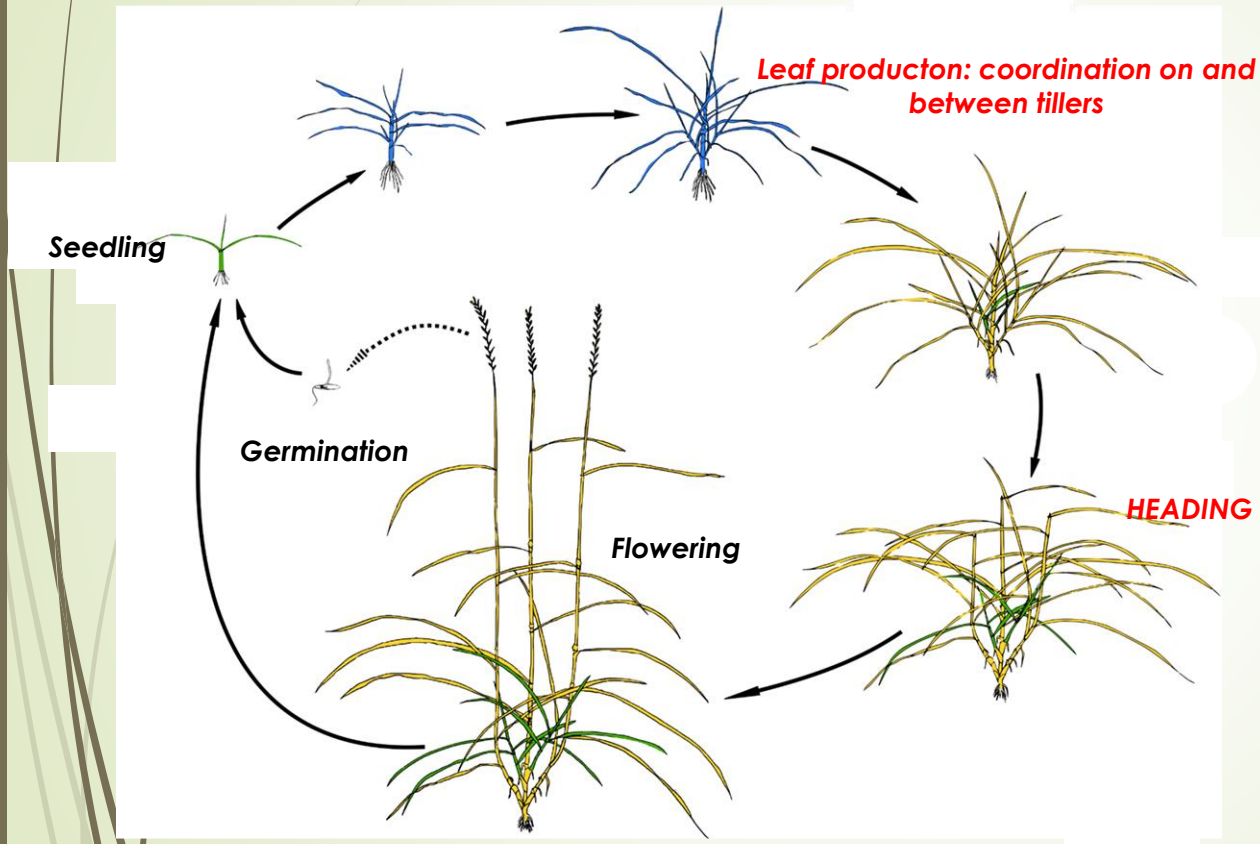
2. Grasses are the dominant group on large area of continents (e.g. grassalnds)

3. The genetic variability between and within species is high and is of first order in determining the geographical distribution of grasses species and populations

4. Although the dependance of Reproductive phenology on climate has been intensively studied, quantitative relationships with temperature and day length are still lacking

INTRODUCTION

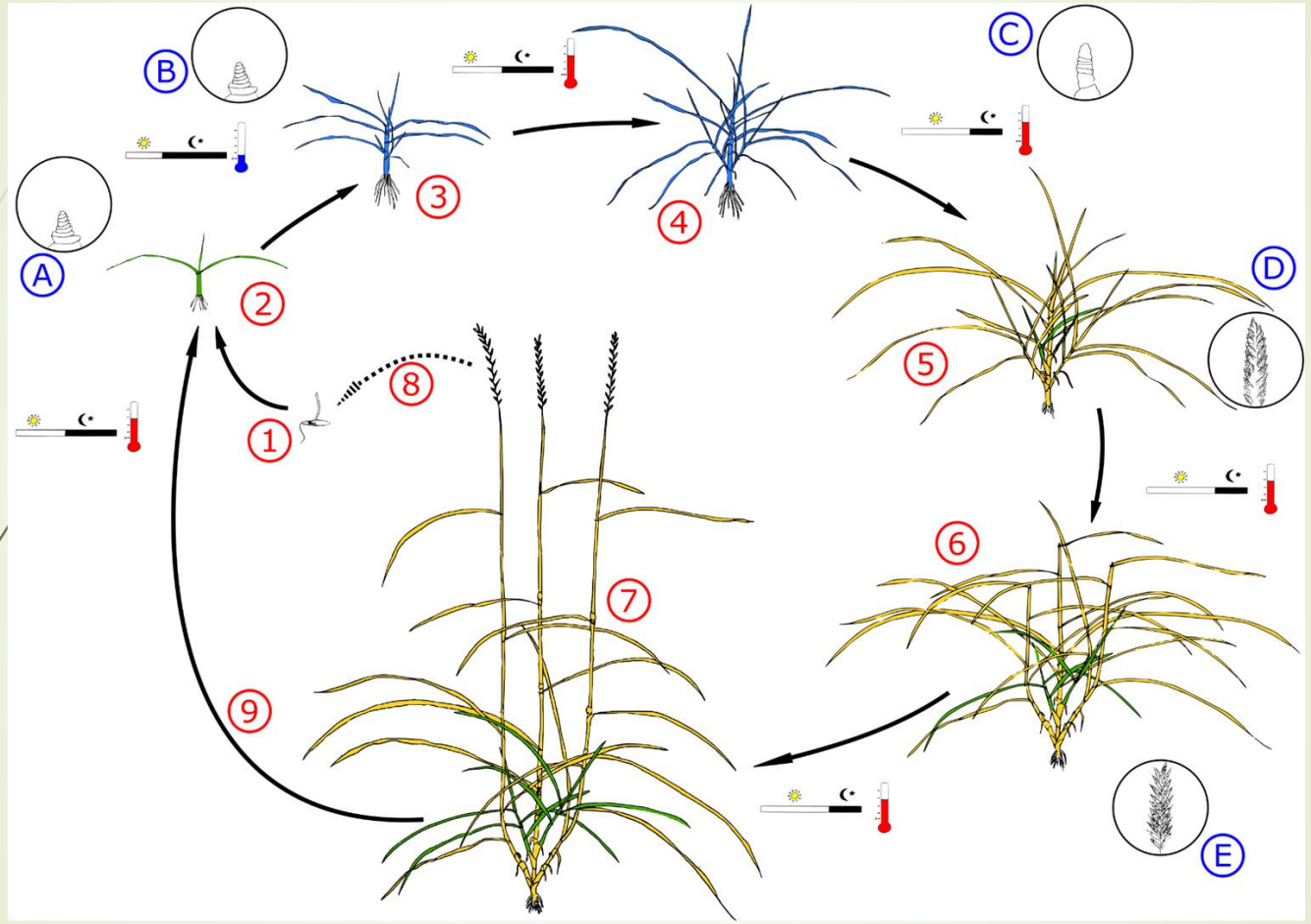
Reproductive phenology of perennial ryegrass (*Lolium perenne*)



How is floral transition at the shoot apical meristem related to leaf growth and what consequences on heading date ?

INTRODUCTION

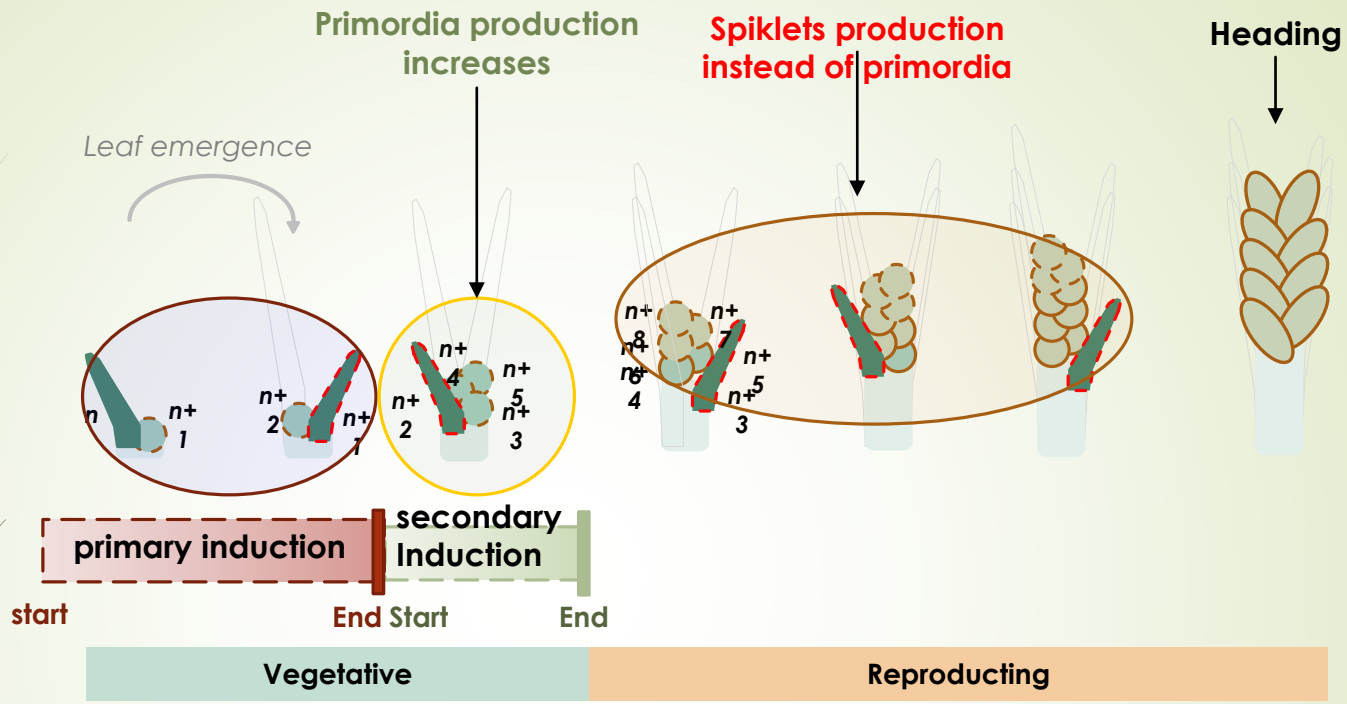
Objectives of the experiment

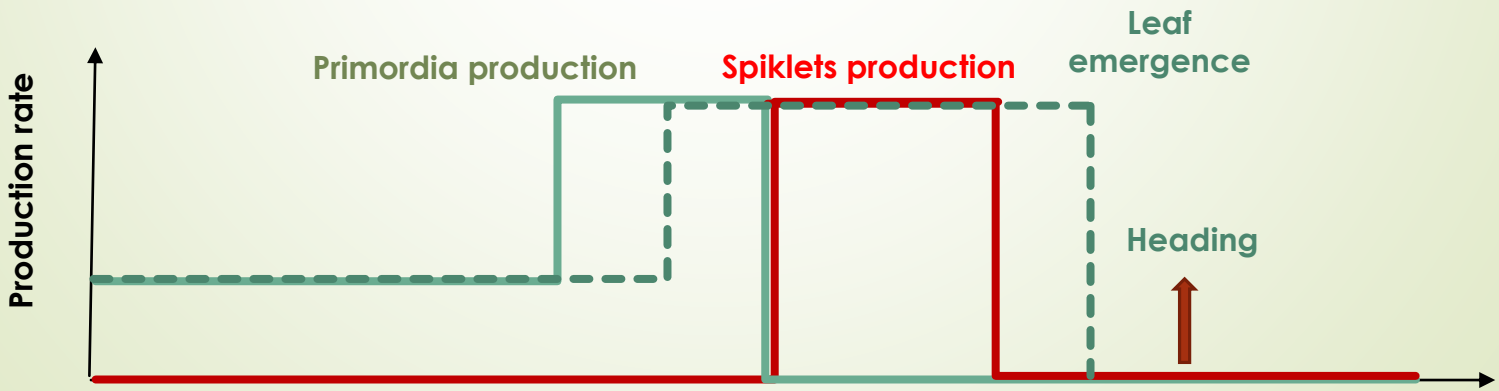


From apex transition to heading, some leaves must grow and emerge.

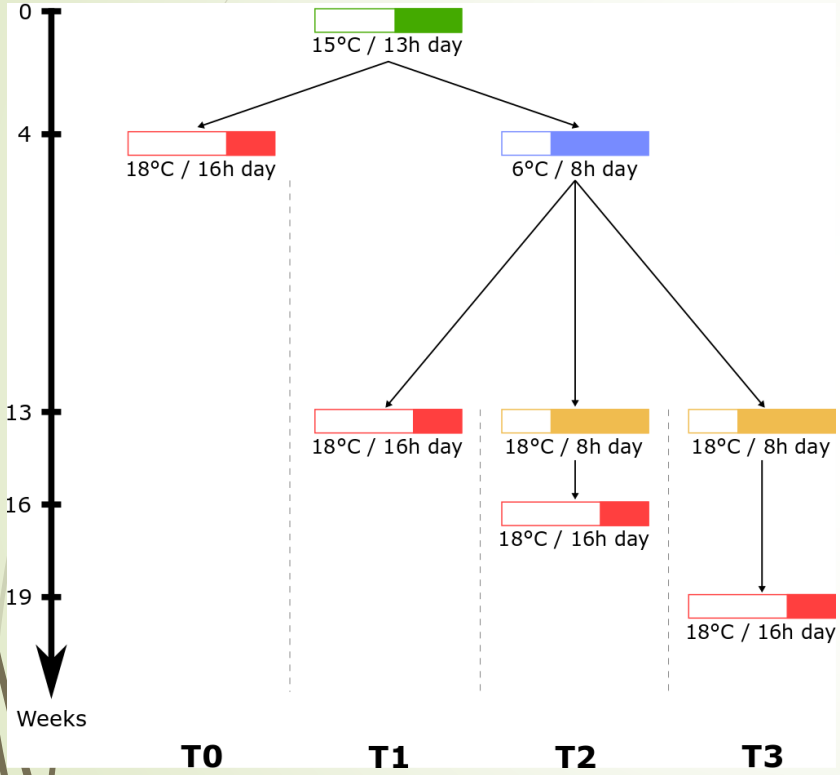
→ **How much does the duration of development from floral transition of apex to heading depend on the production and growth of leaves ?**

Hypothetical functioning of the Shoot apical meristem





MATERIAL AND METHODS



Growth chambers at 6 or 18 °C.
From 8h photoperiod to 16h photoperiod:
using 8 µmoles photon flux density

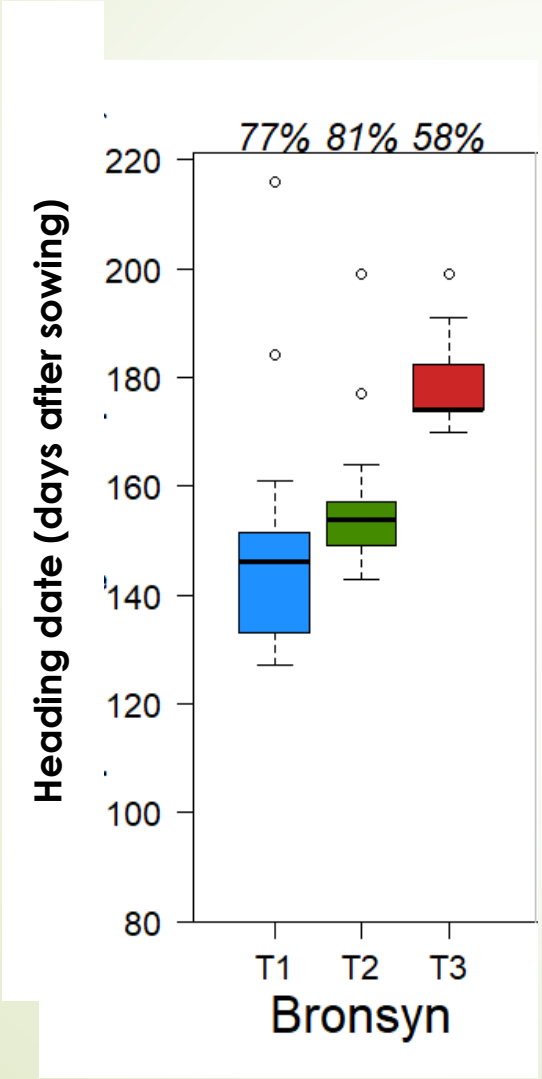
3 varieties :
Bronsyn, Carvalis et Tryskal

Plant measurements

- Leaf emergence
- Leaf length
- Heading date

RESULTS 1. HEADING DATE

1. No spikes with plants continuously exposed to 18 °C (T0).



2. The later the long day regime started, the later heading occurred

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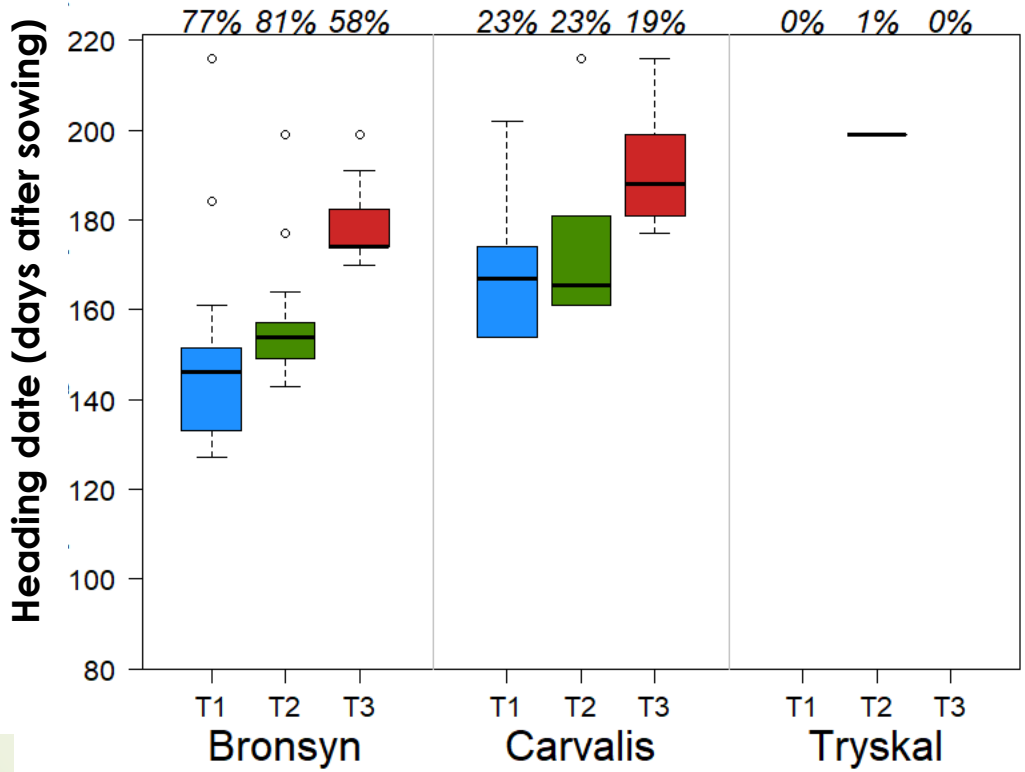

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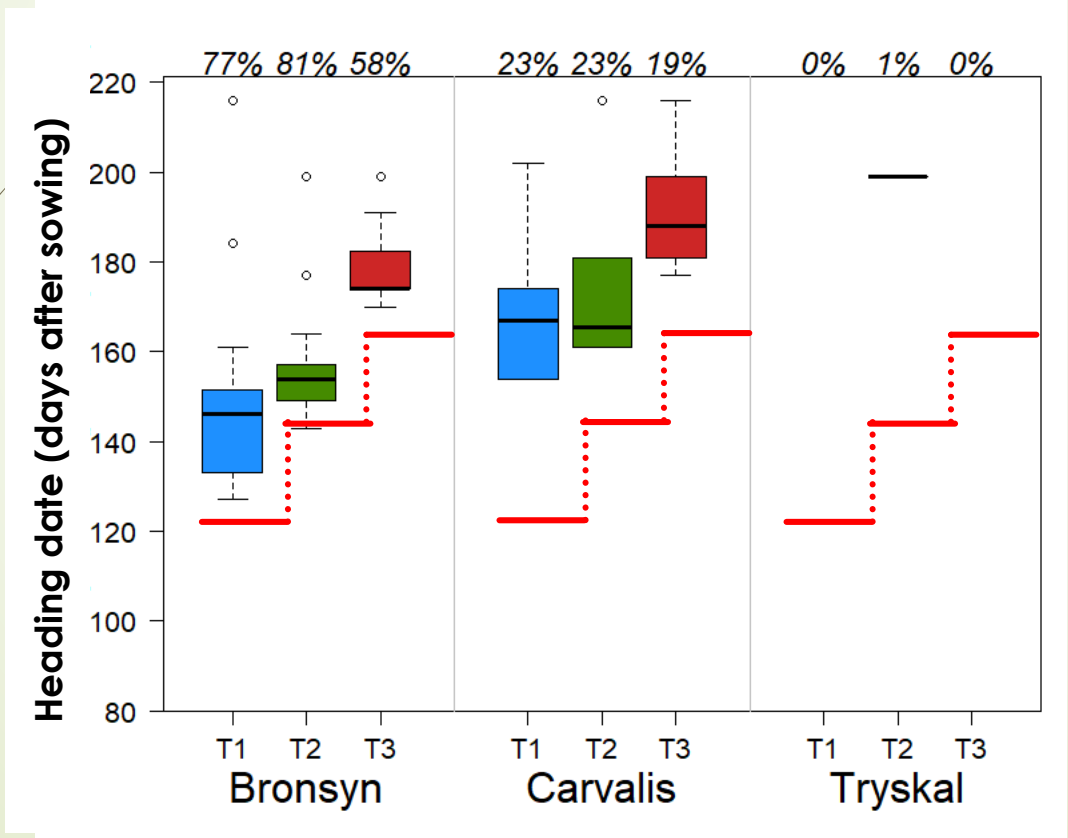
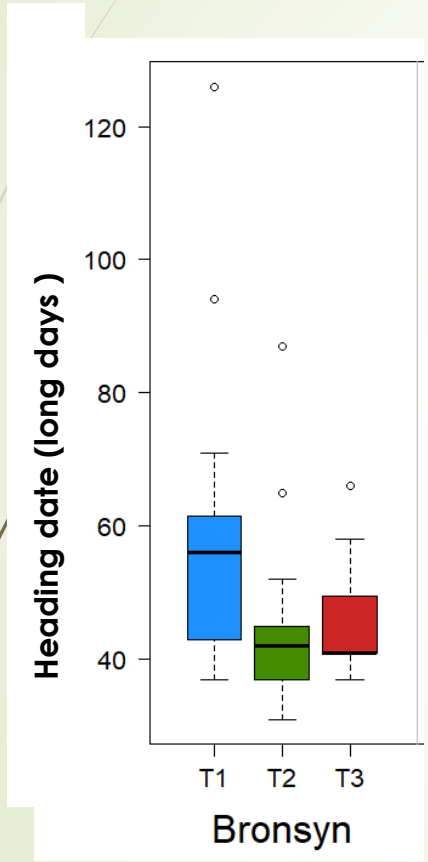


RESULTS 1. HEADING DATE

The longer at high temperature under short day regime, the faster it reaches heading following transfer to long days



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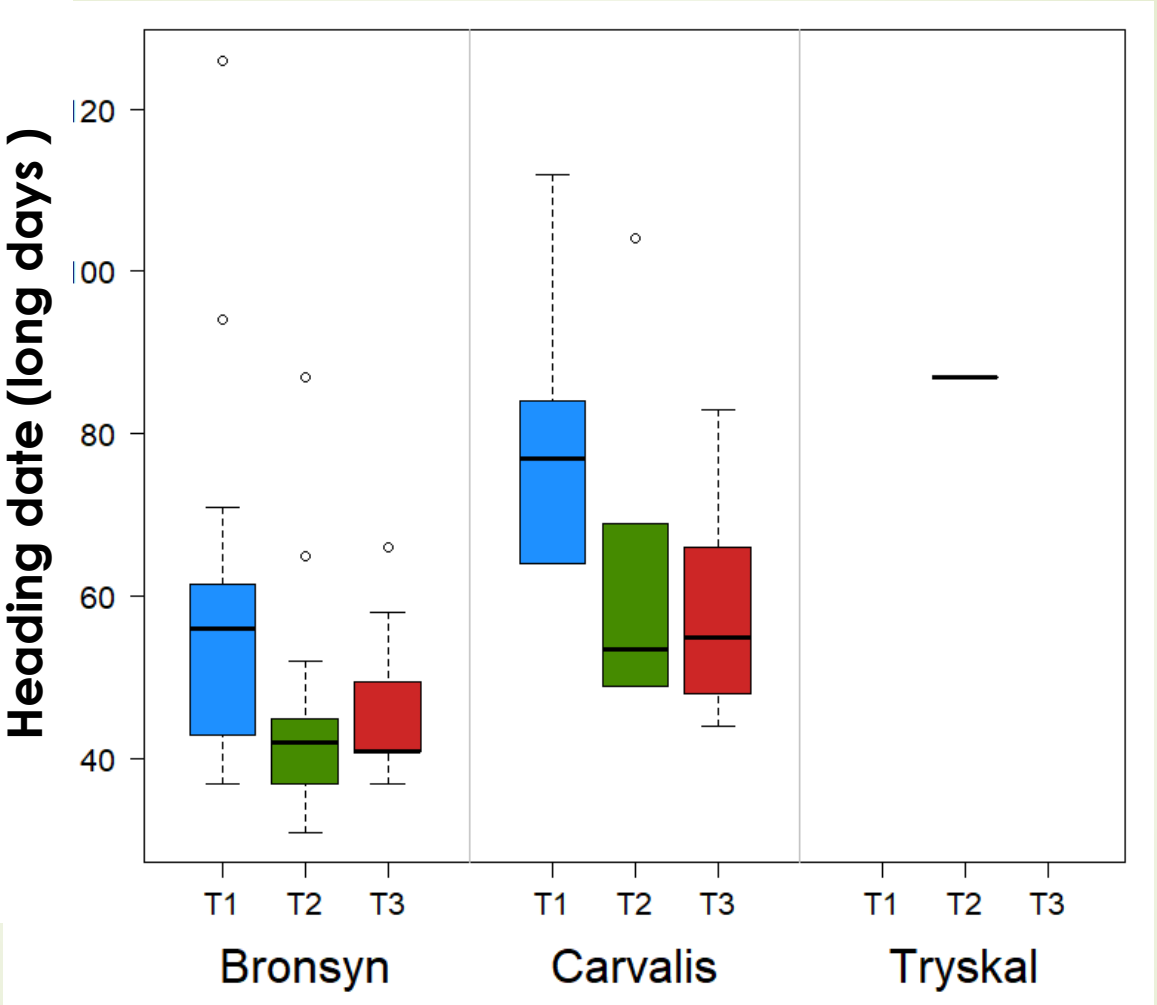
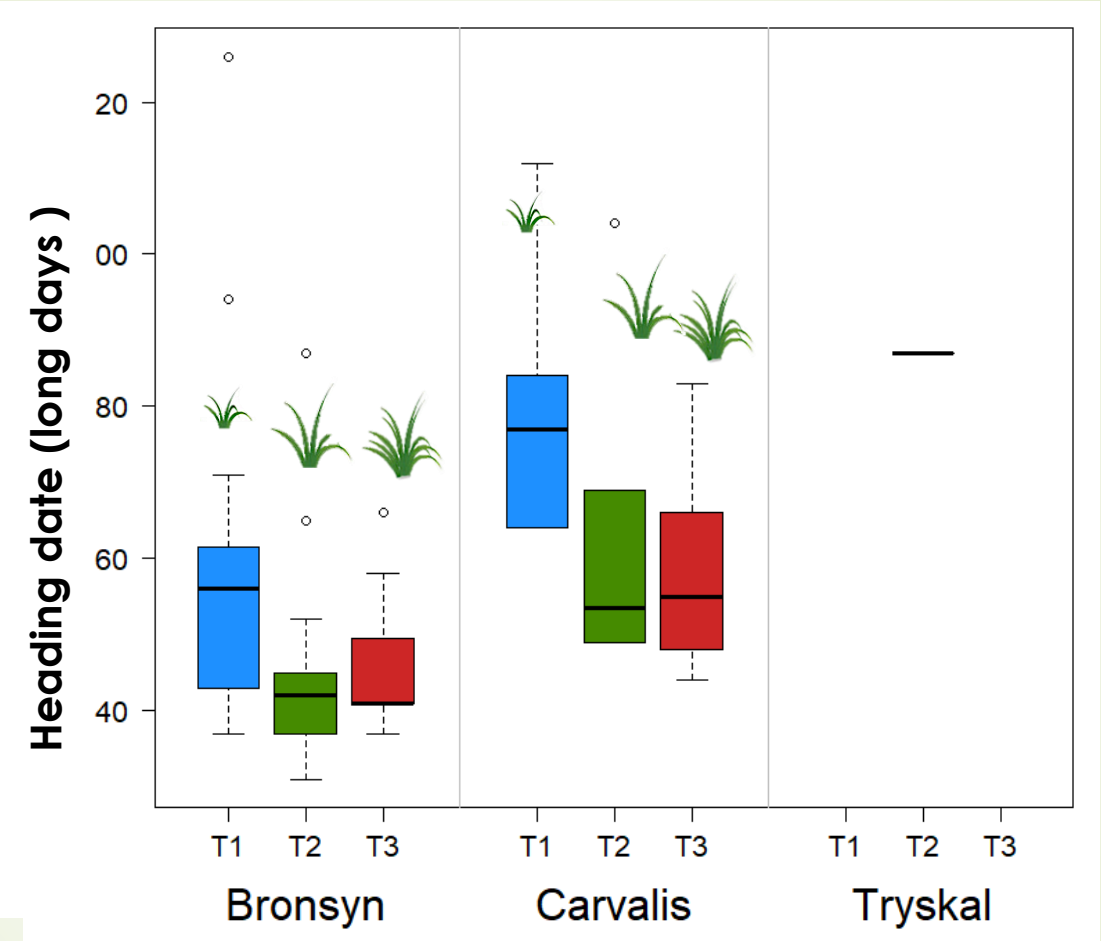


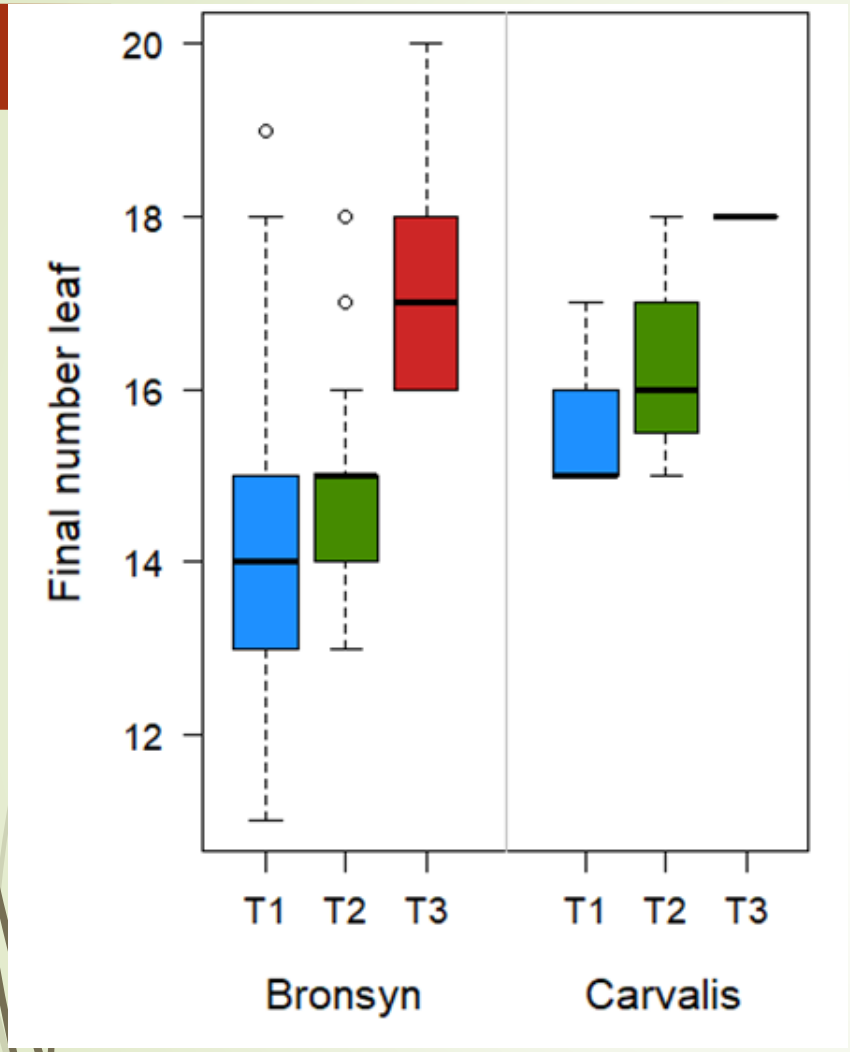
Larger vegetative tillers convert faster into repoductive tillers than smaller ones

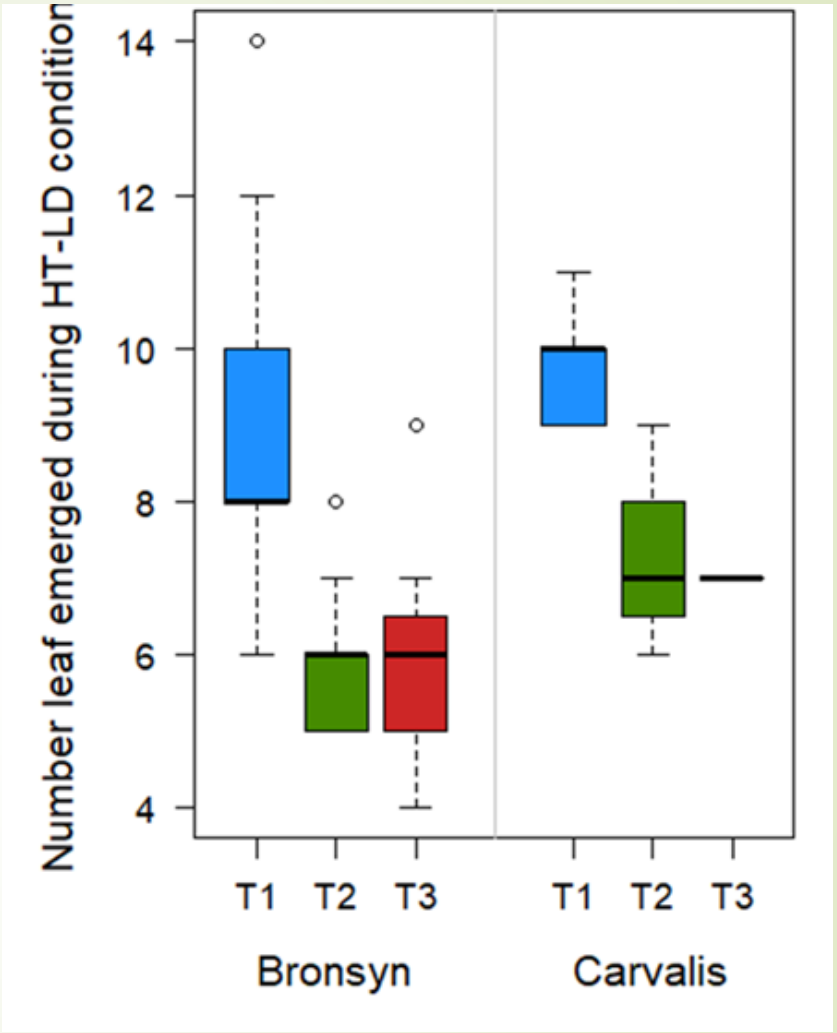
RESULTS 1. HEADING DATE



1. **Primary induction is necessary but not sufficient**
2. **Secondary induction starts immediately with exposure to long days**
3. **The plant development or growth partly controls the rate of rate of floral induction.**

RESULTS 2. LEAF PRODUCTION





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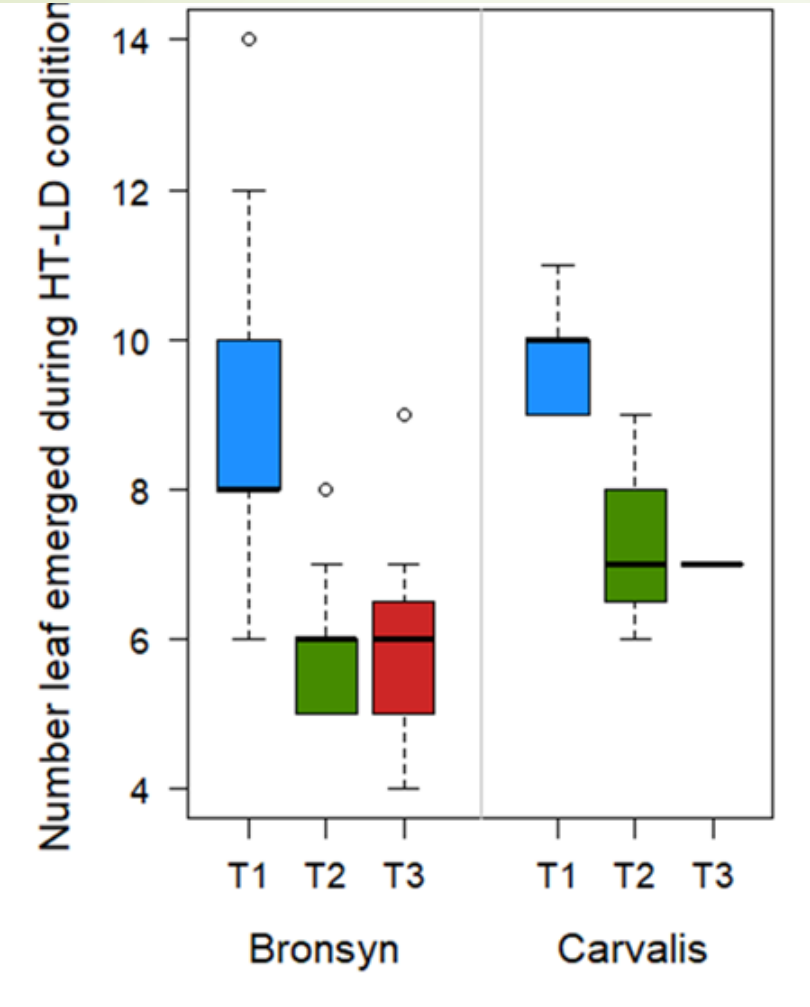
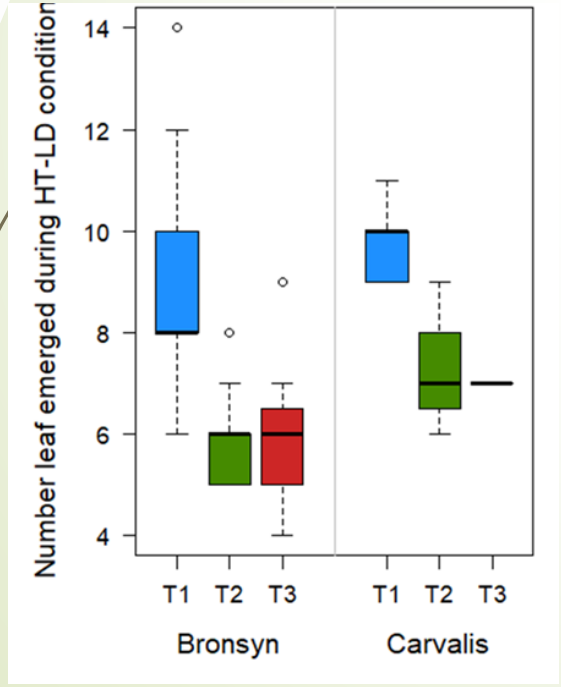
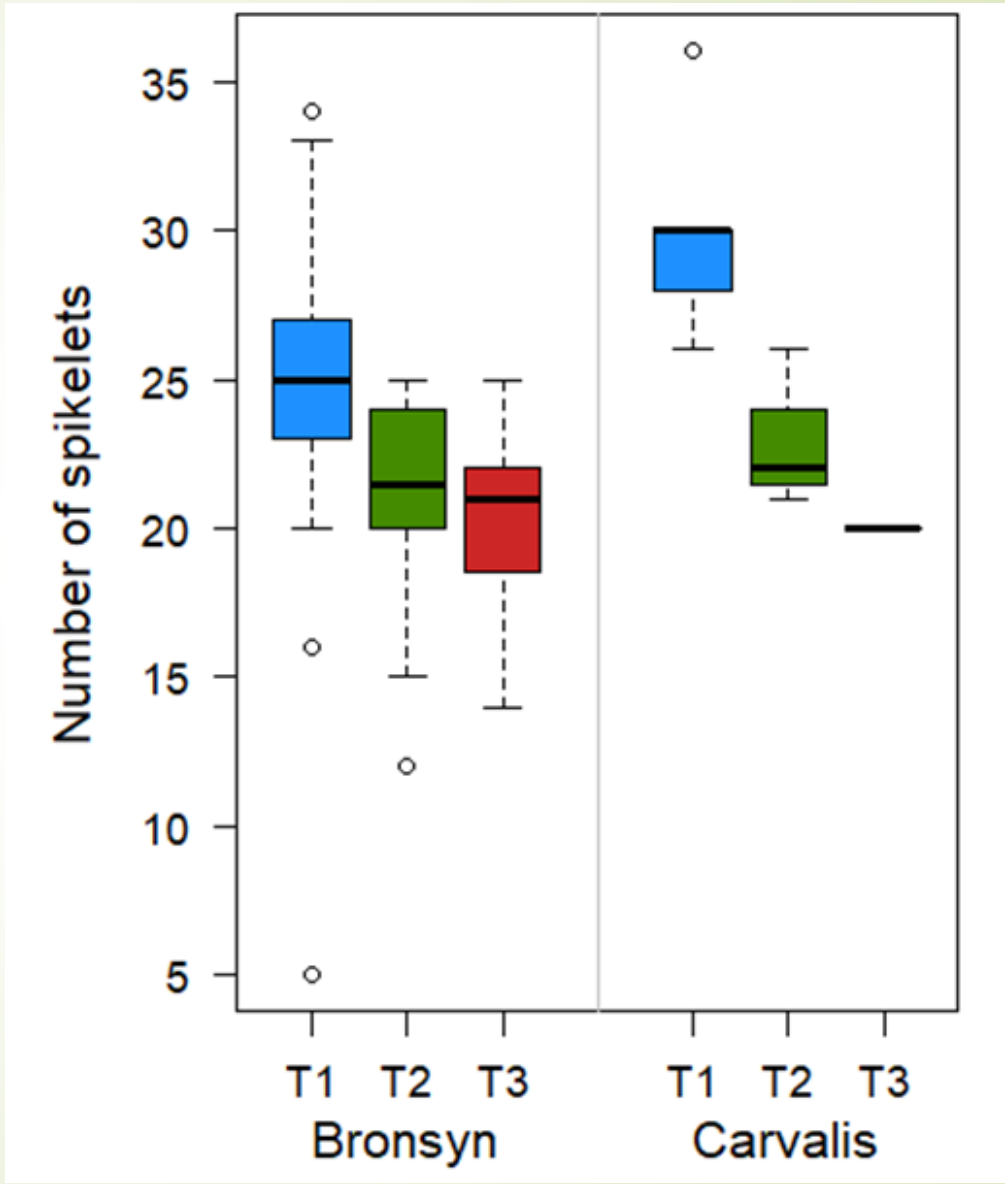


→ **Some of the leaves emerging under long day regime were produced during secondary induction**

→ **the rate of leaf production increased during secondary induction (eg : by 4 .5),**

RESULTS 3. NUMBER OF SPIKELETS





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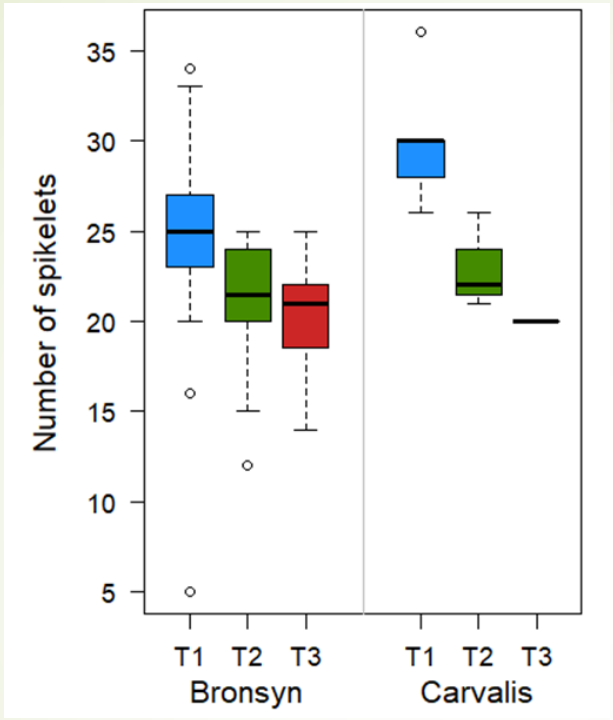
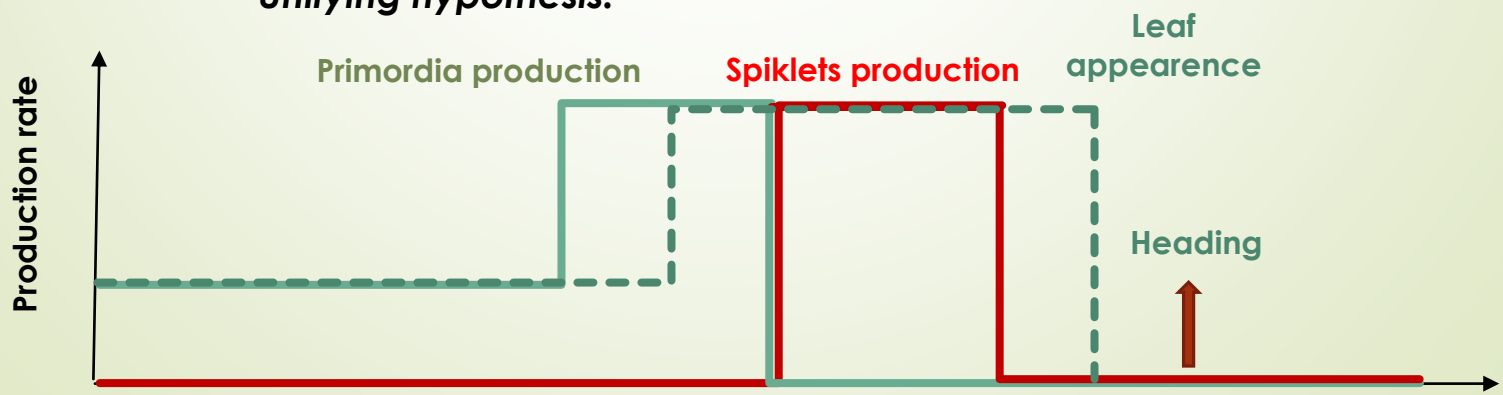
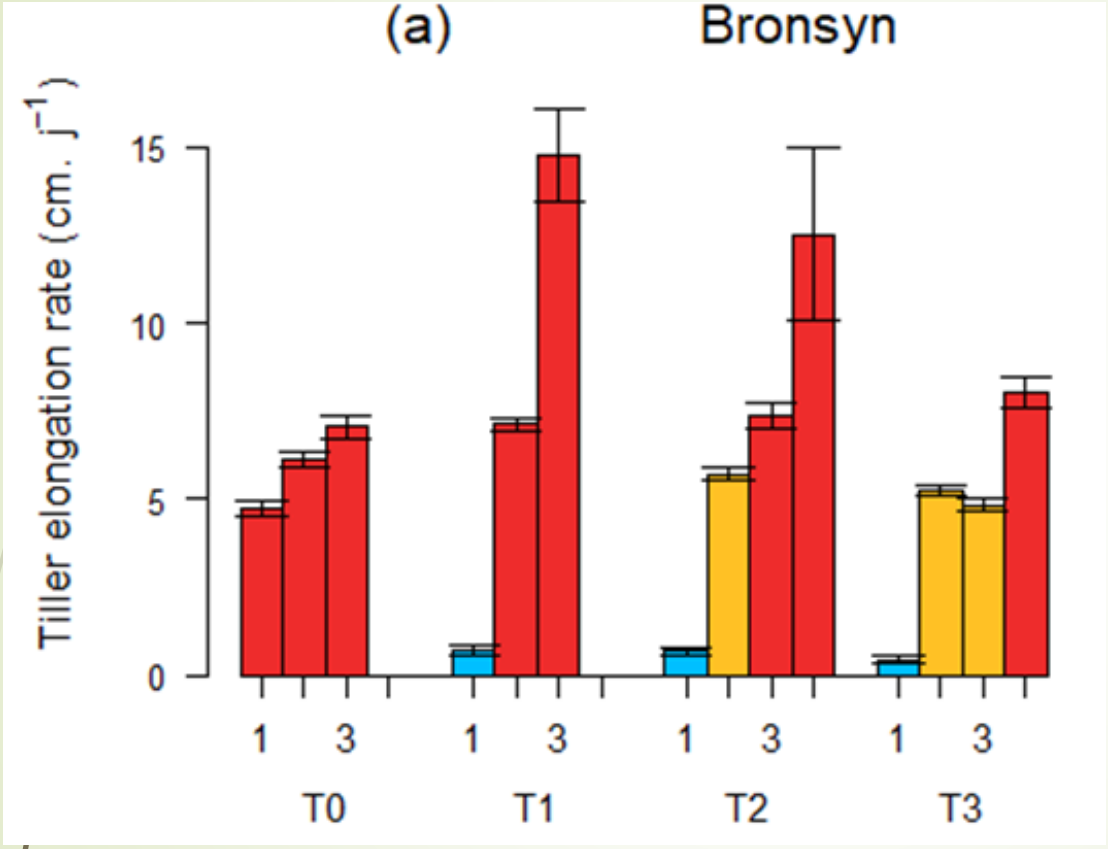


- *The production of spikelets primordia starts at floral induction*
- *The number of spikelets depends on the number of leaves produced following the beginning of secondary induction*
- *The longer it takes to unfold all leaves, the longer the apex has to produce more spikelets.*

Unifying hypothesis:



RESULTS 4. LEAF ELONGATION RATE PER TILLER



Cold+ short days

Hot + short days

Hot + long days

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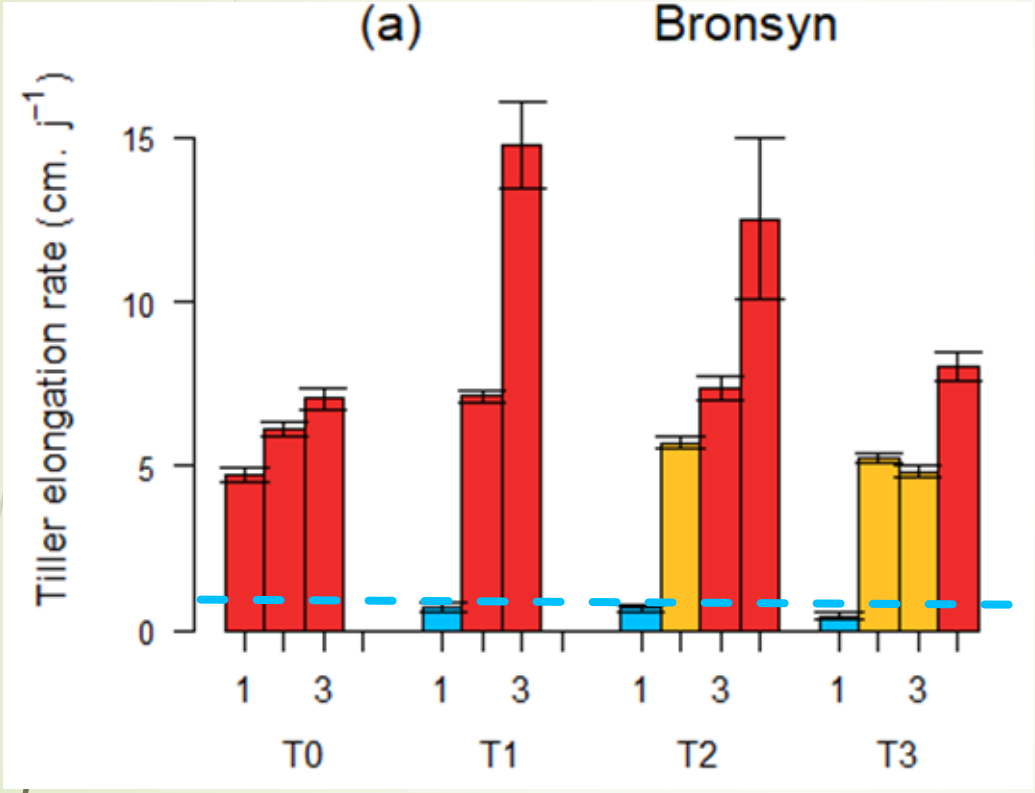

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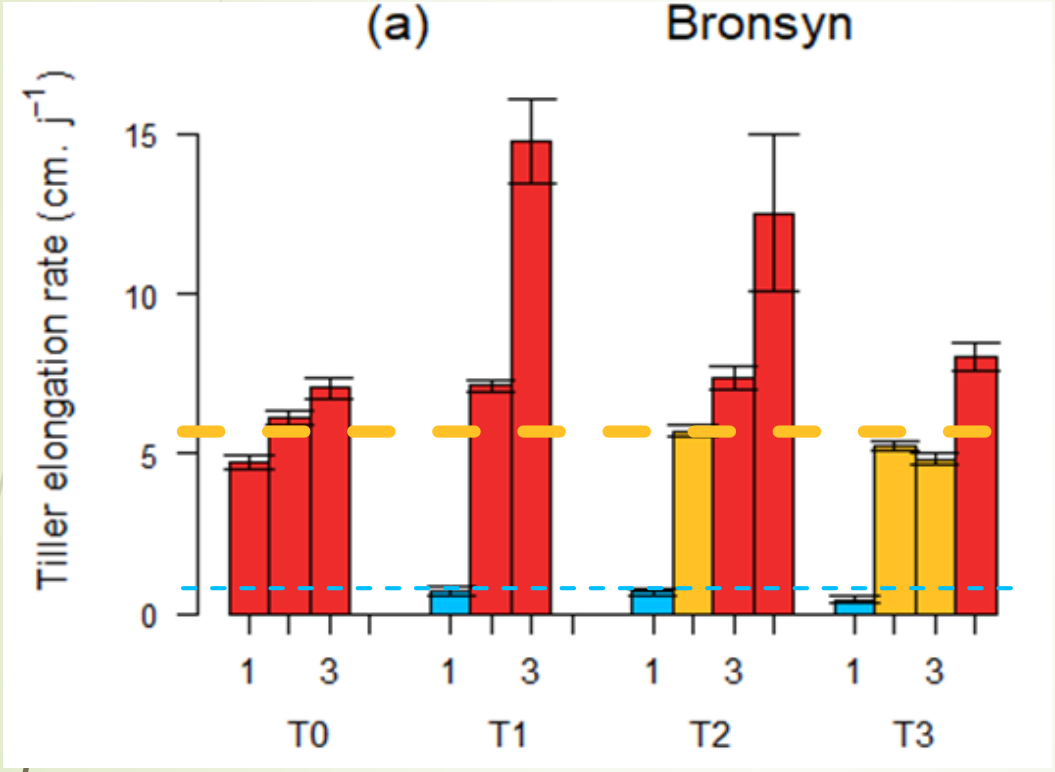


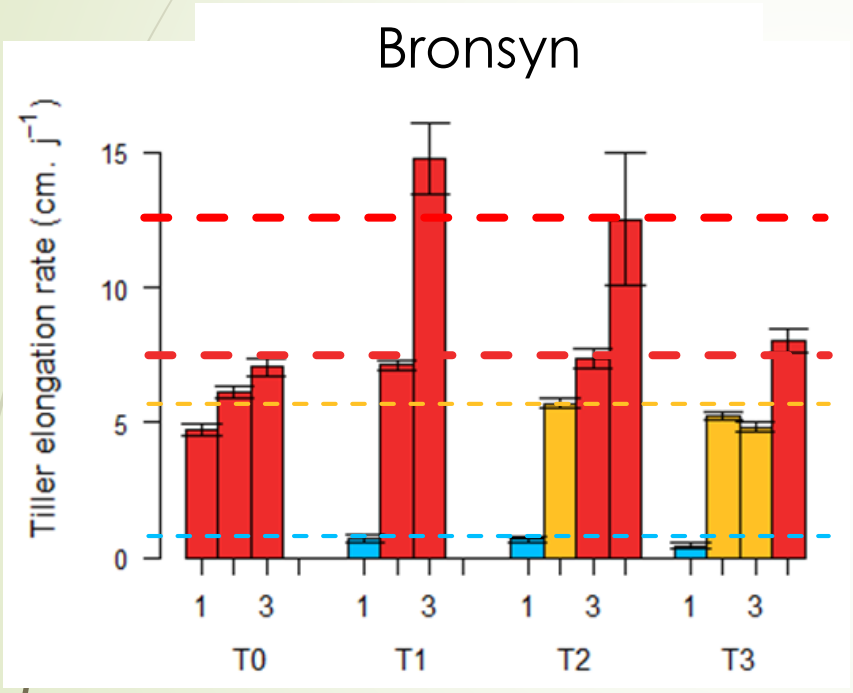
① **TEMPERATURE INCREASE**

Cold+ short days

Hot + short days

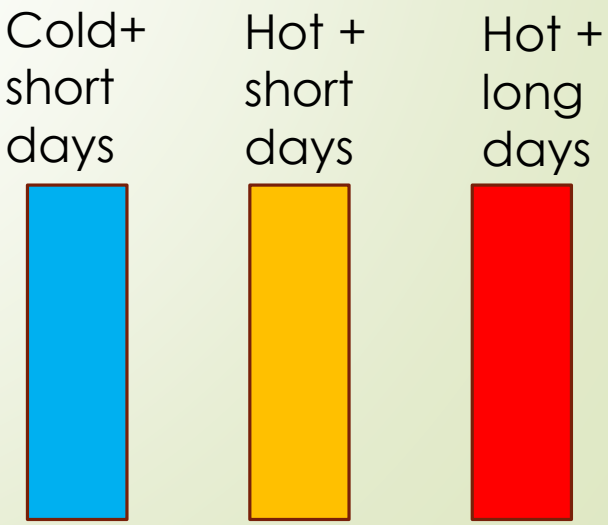
Hot + long days

RESULTS 4. LEAF ELONGATION RATE PER TILLER



①

② **GRADUAL IMPACT OF INCREASED DAY LENGTH**



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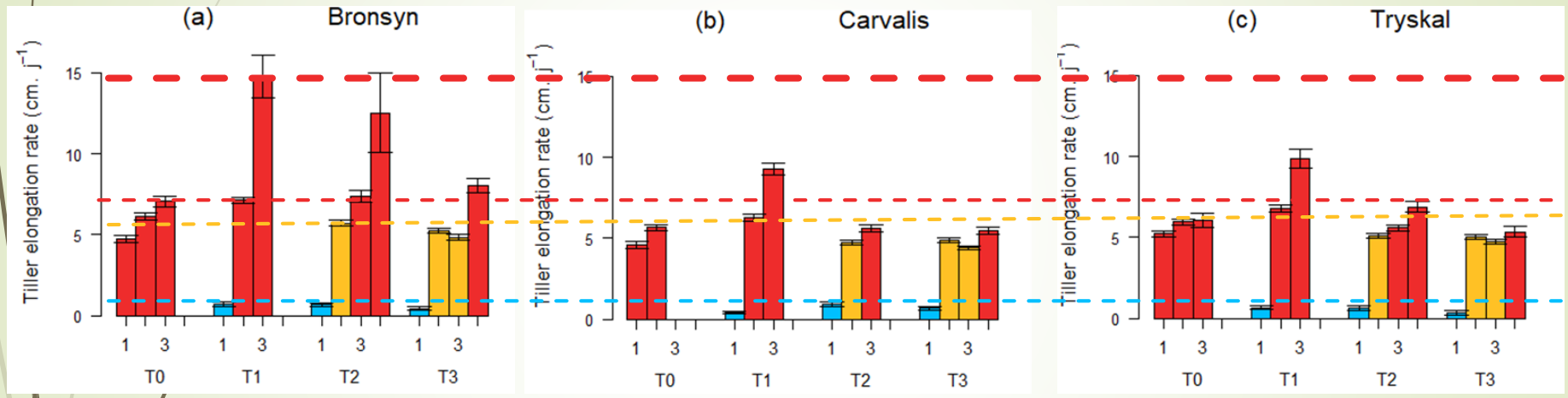

① **TEMPERATURE INCREASE**

② **GRADUAL IMPACT OF INCREASED DAY LENGTH**

③ **SUPPLEMENTARY INCREASE DUE TO REPRODUCTIVE STATUS**

Conclusions

1. The complex coordination and rate of leaf production, leaf elongation and spikelet production could be related to temperature and day length.

2. The sequence of floral transition of the apex was implemented in L-Grass F following enabling a quantitative assesment of the genetic variability of the response of heading to climate (Rouet et al 2021, *Frontiers in Plant Science* & Rouet et al, *In Silico Plant* (in press)

3. More research is needed in order to establish directly the response of shoot apical meristem to environment : Welcome to the first European Conference : « from Gene to Plant Architecture : the shoot apical meristem ». Poitiers 28-30 Novembre 2022.

https://ifm2a2.symposium.inrae.fr/