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

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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. grasslands)

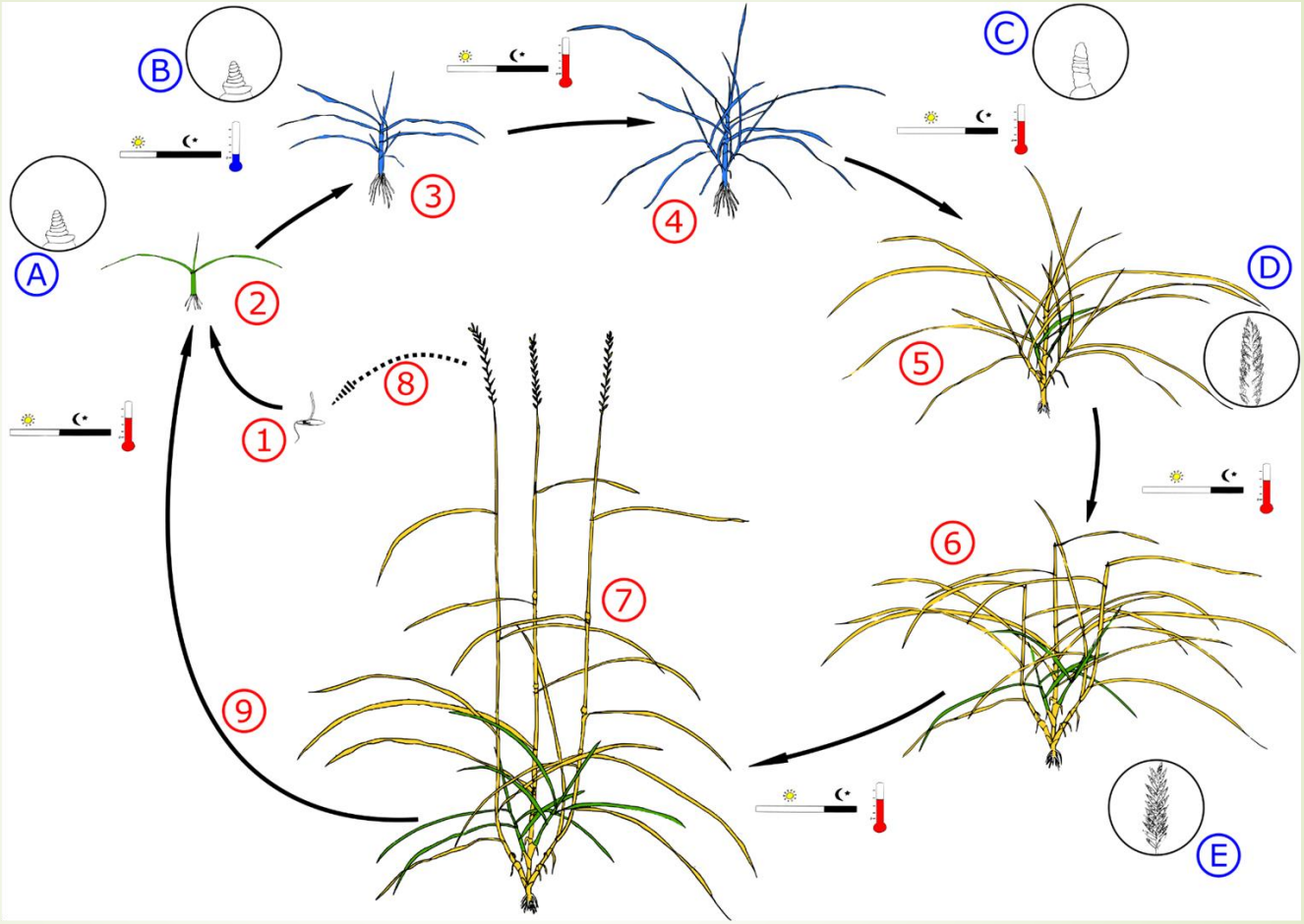
3. The genetic variability between and within species is high and is of first order in determining the geographical distribution of grasses species and populations

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

5. The coordination and rate of leaf production, leaf elongation and spikelet production must be related to temperature and day length → complex question.

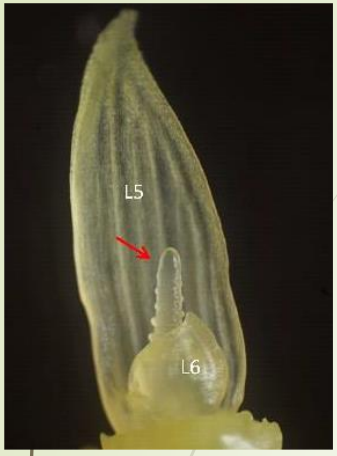
6. We need a model in order to integrate the various events at the apex level at the whole plant level and fully quantify the role of T and day length on reproductive phenology of grasses.

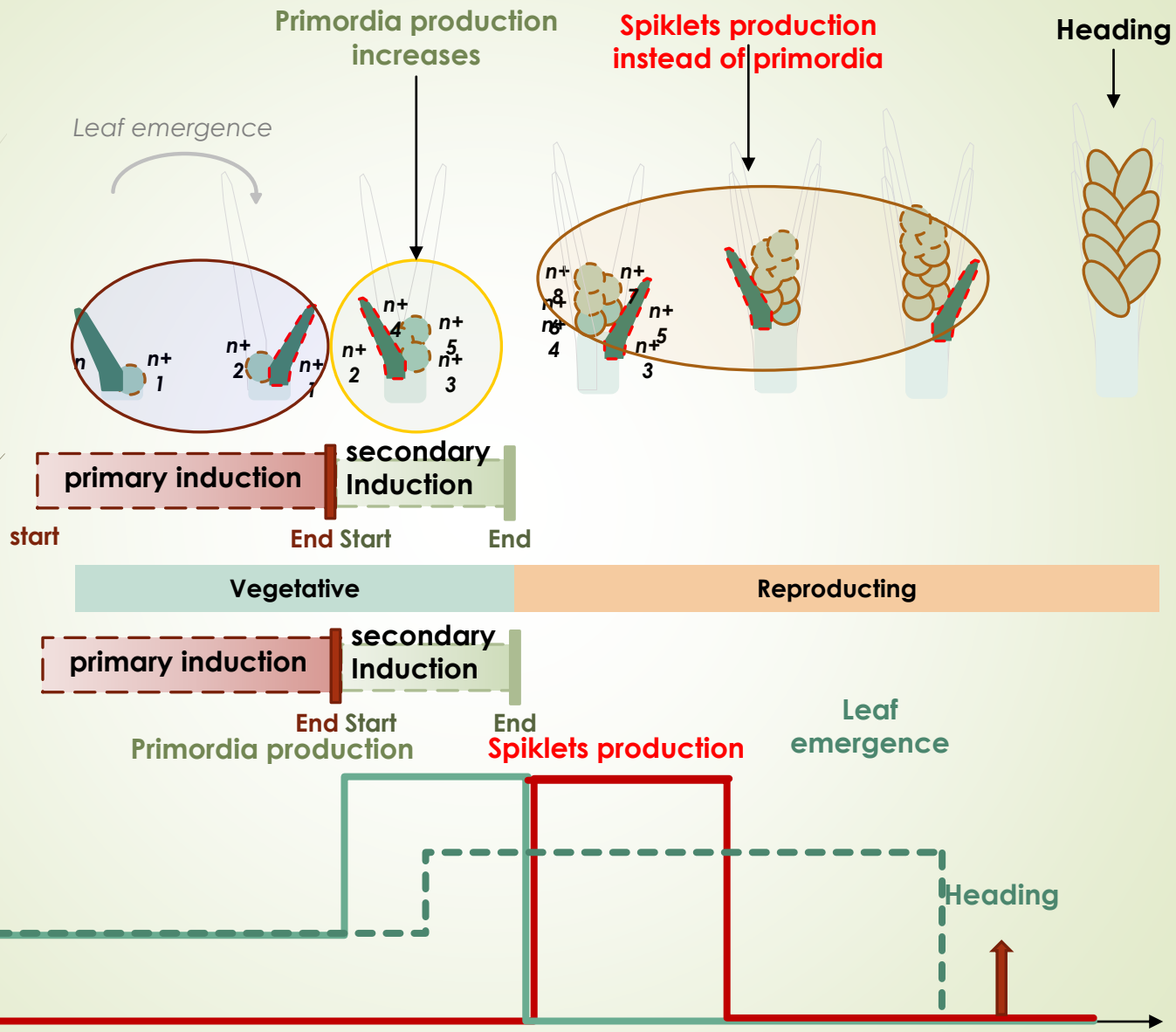
INTRODUCTION



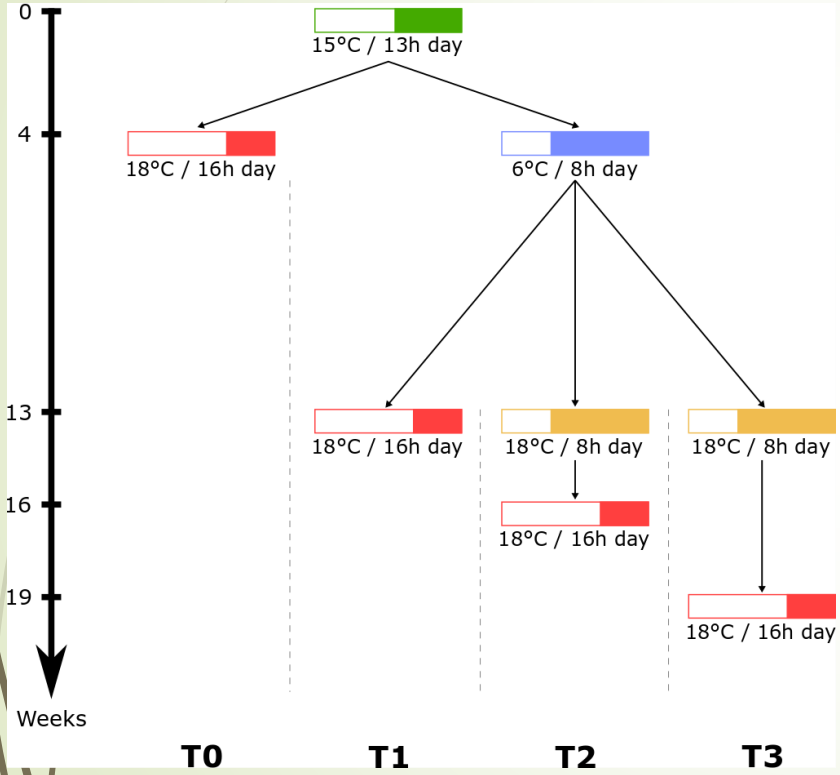
→ **Heading date not only depend on the date of the threshold day length, but also on the time it takes to unfold all previously produced primordia.**

Hypothetical functioning of the Shoot apical meristem





MATERIAL AND METHODS



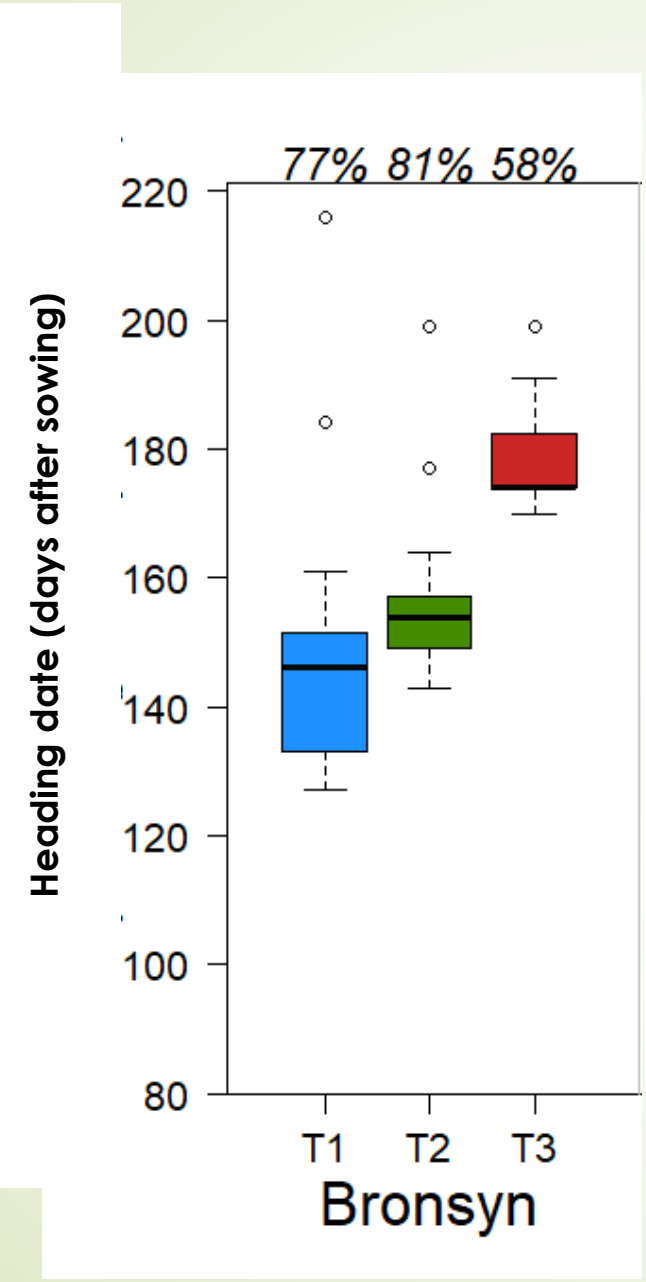
Growth chambers at 6 or 18 °C.
From 8h photoperiod to 16h photoperiod:
using 8 µmoles m^{-2} s^{-1} flux density

3 varieties :
Bronsyn, Carvalis et Tryskal

Plant measurements

- Leaf emergence
- Leaf length
- Heading date
- Number of spikelets

RESULTS 1. HEADING DATE

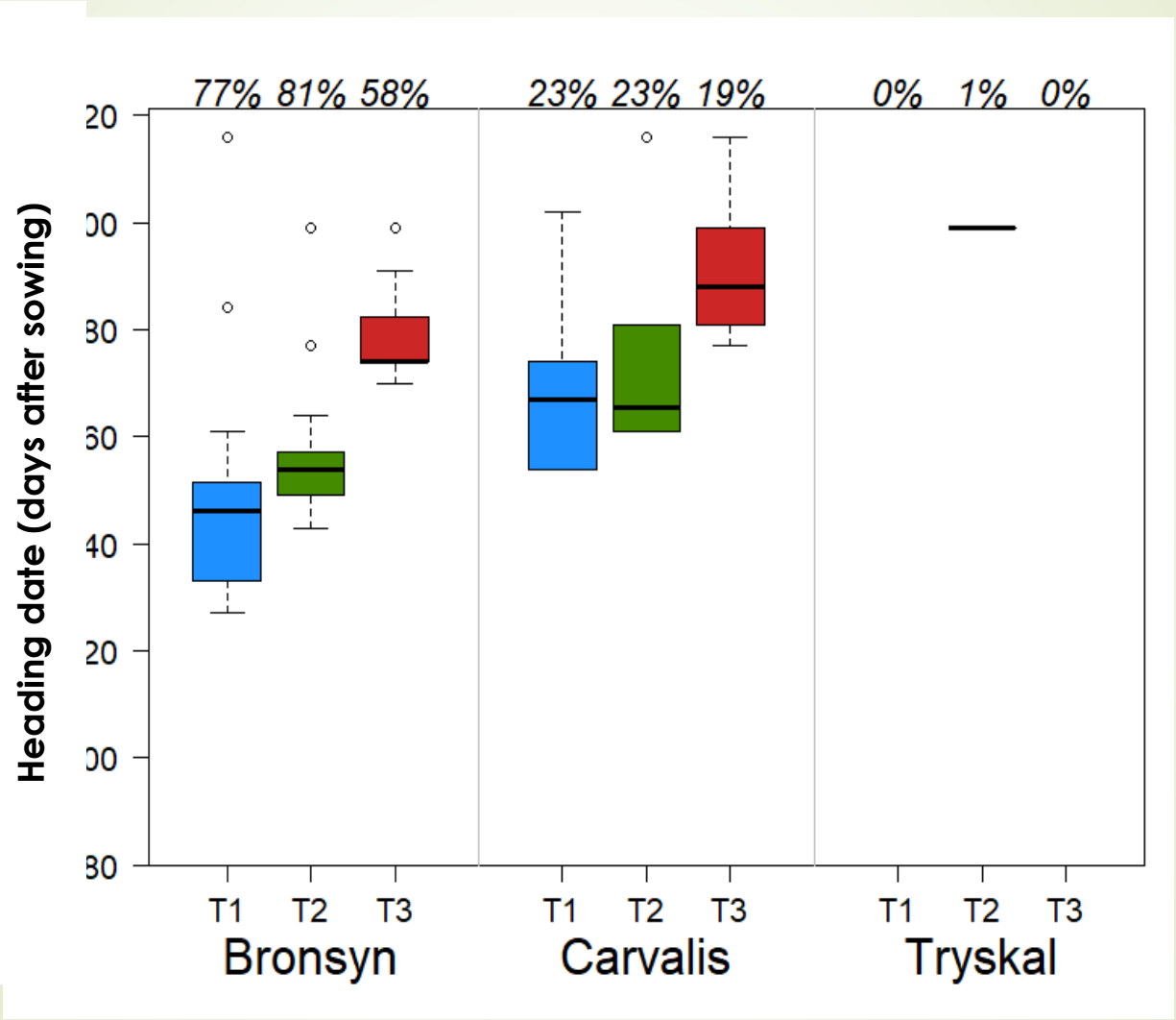


1. No spike with plants continuously exposed to 18 °C under long days (T0).

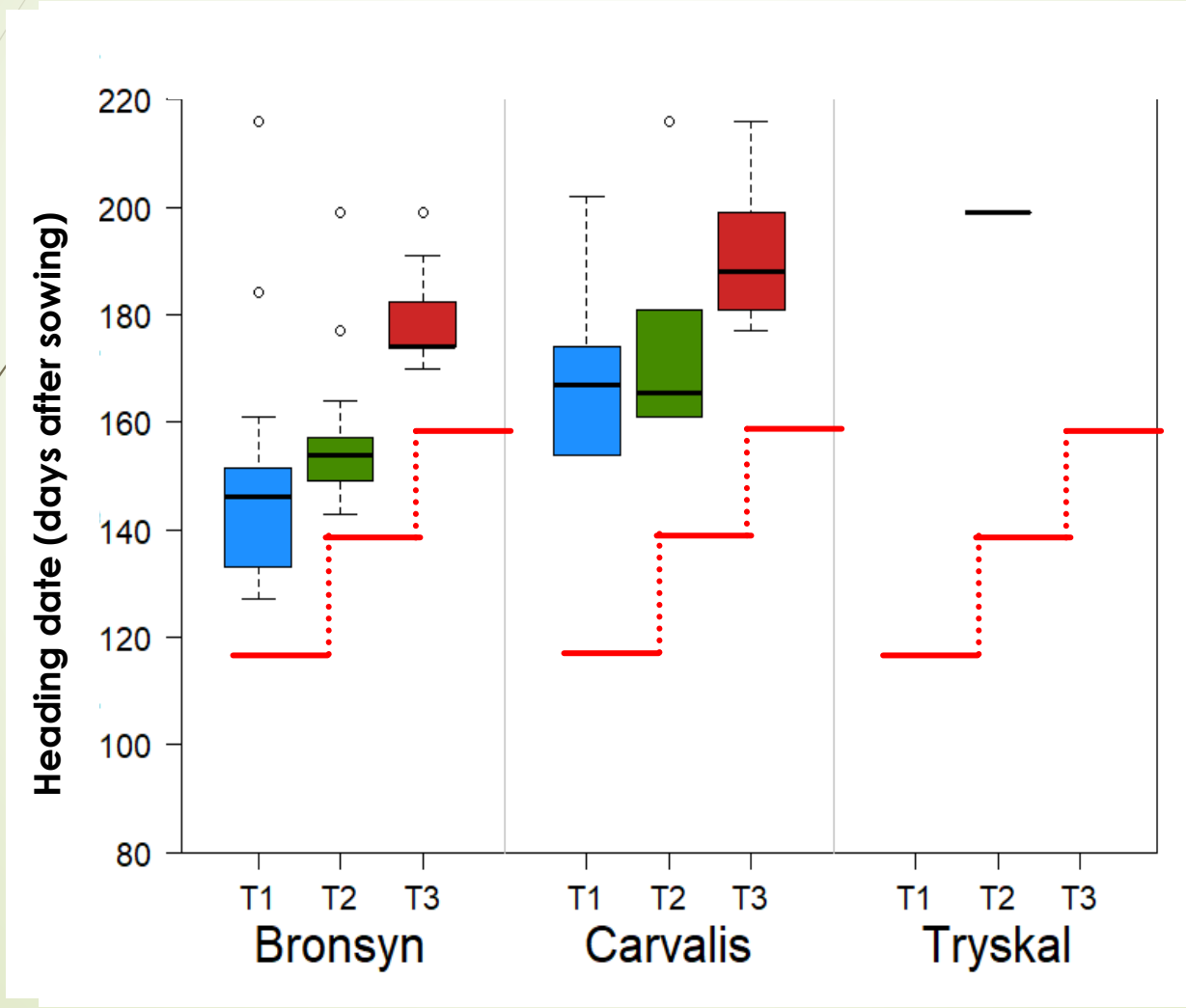
2. The later the long day regime started, the later heading occurred

RESULTS 1. HEADING DATE

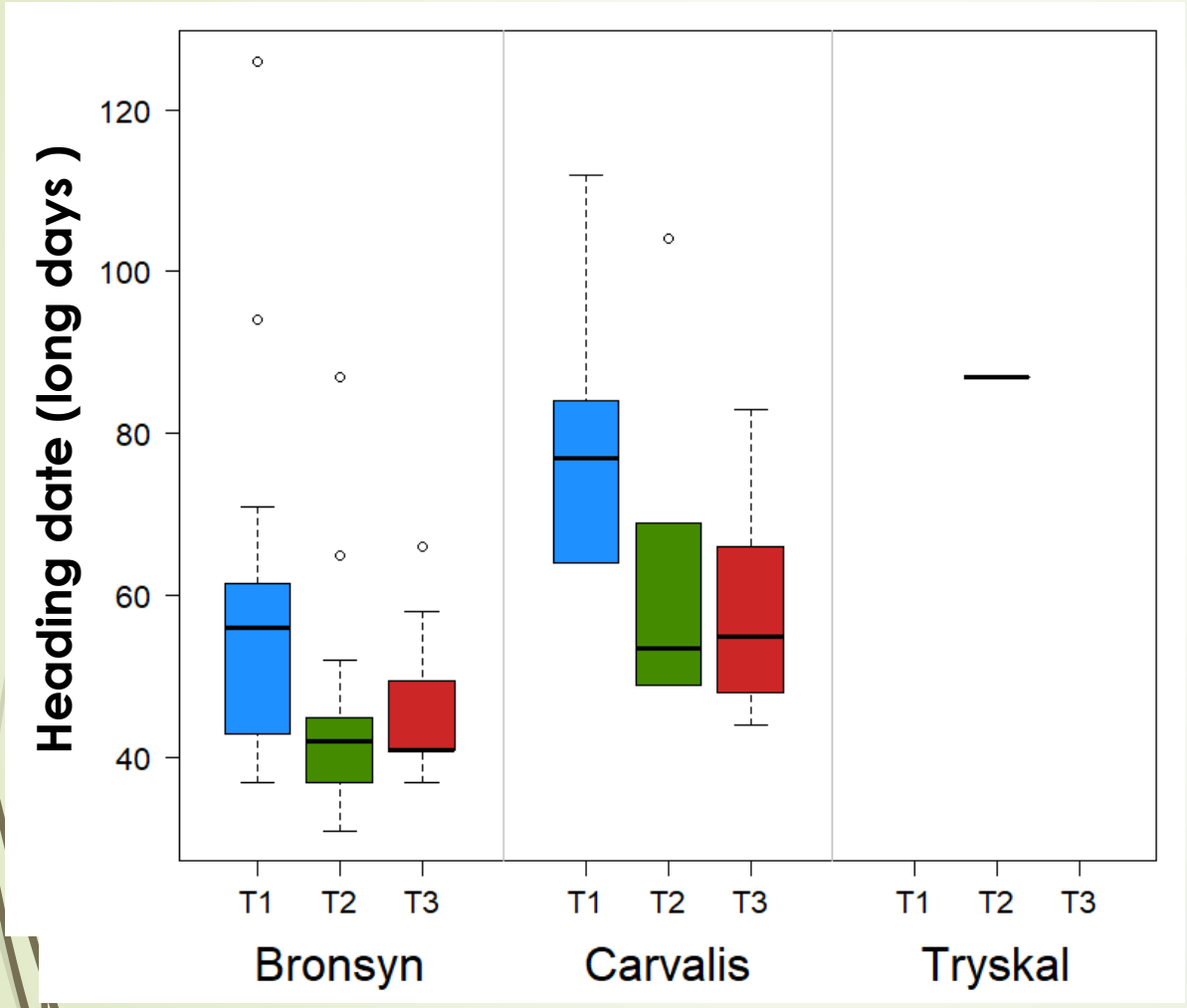
Similar results in both flowering varieties



RESULTS 1. HEADING DATE



RESULTS 1. HEADING DATE

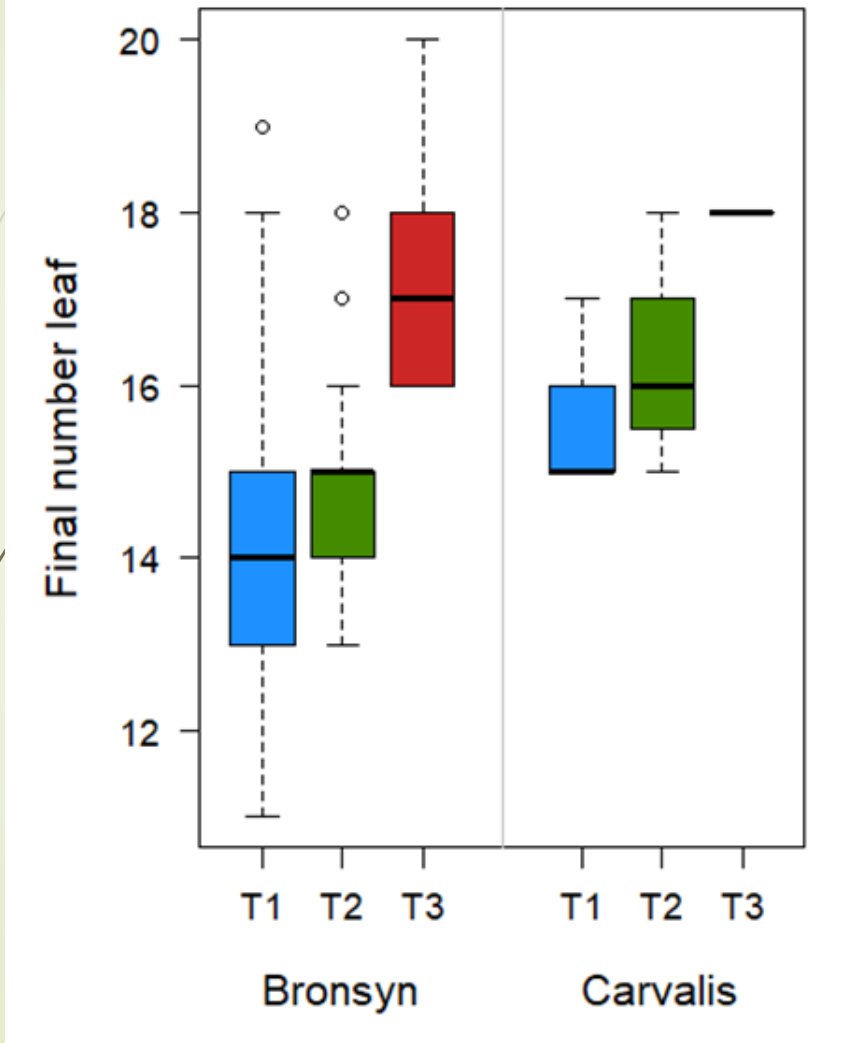


The longer at high temperature under short day regime, the faster tillers reached heading following transfer to long days

Also the longer at high temperature and short days, the bigger they were when transfered to long day regime.

→ Large vegetative tillers converted faster into repoductive tillers than smaller ones

RESULTS 2. LEAF PRODUCTION

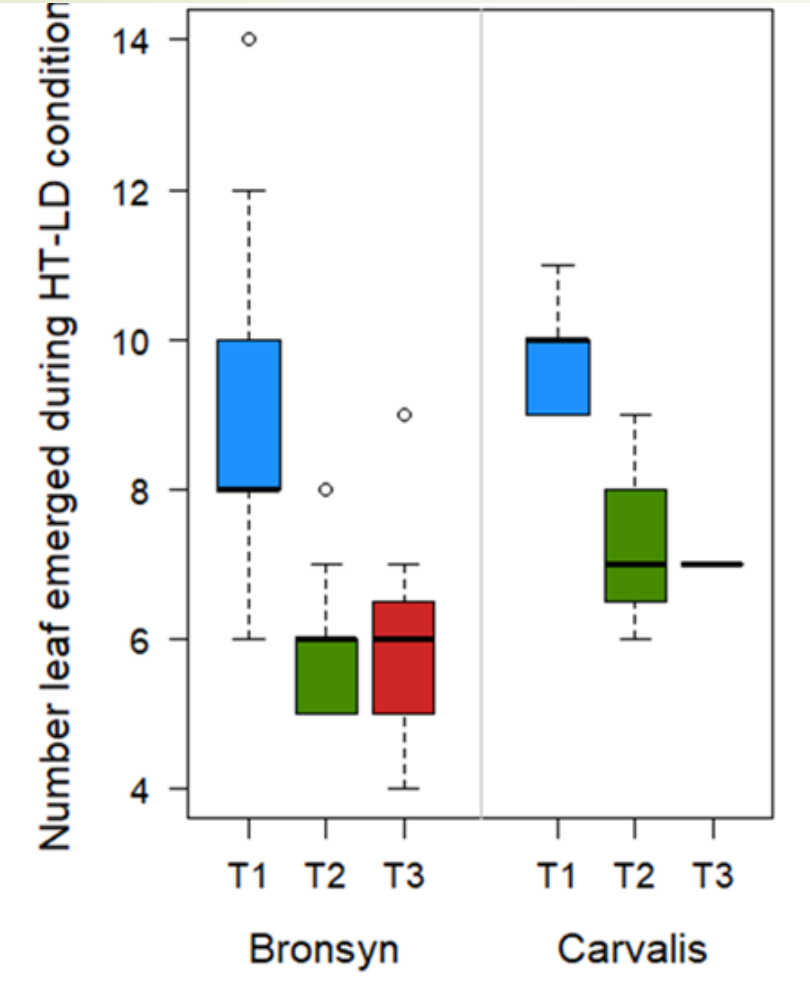


A longer time under 18 °C and short day produces more leaves at the end of the experiment.

The final number when the last leaf reach its final length is an evidence for a very significative acceleration in leaf production rate.

Such an acceleration was due to exposition to long days: how many leaves were produced during that period ?

RESULTS 2. LEAF PRODUCTION



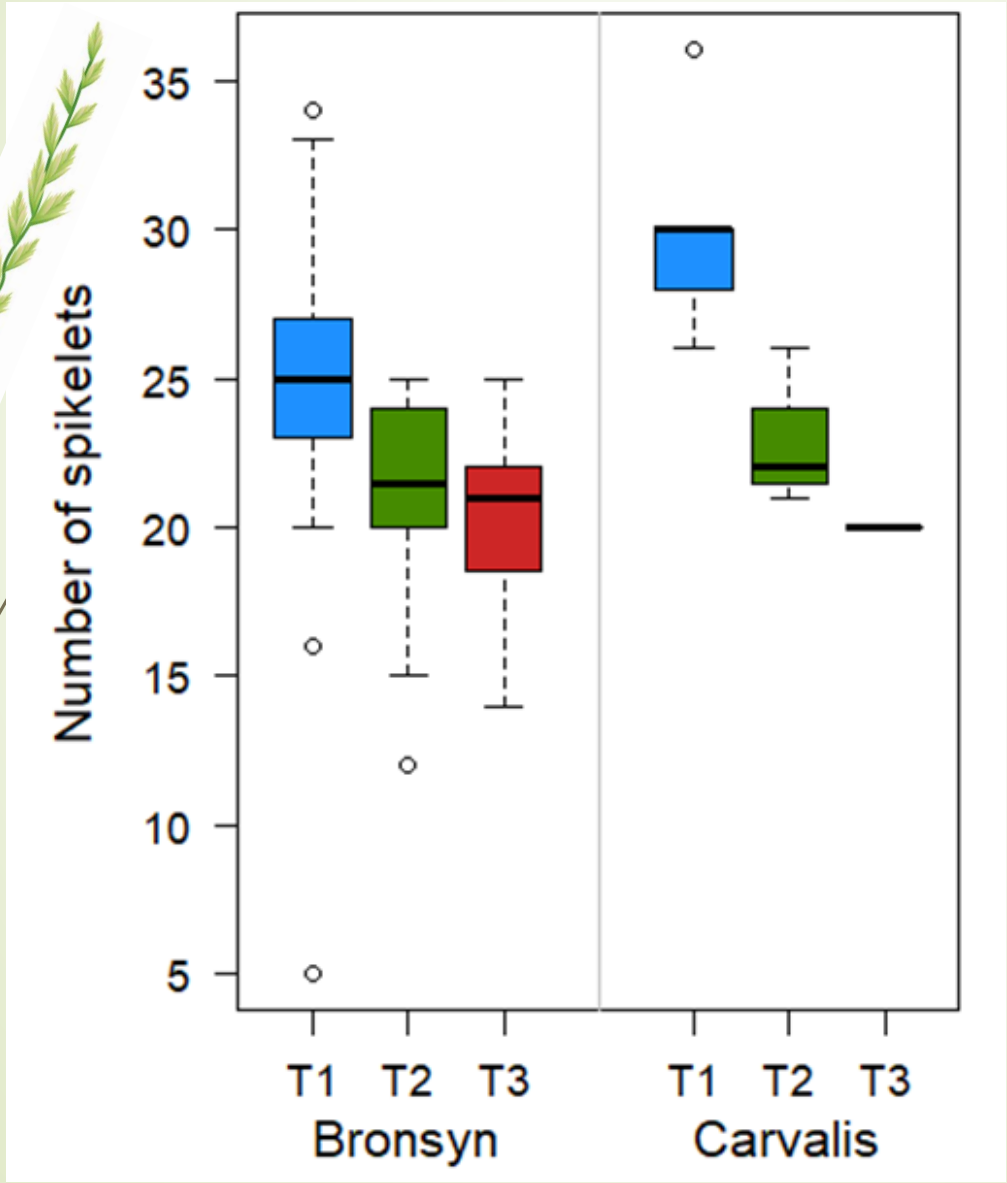
Less leaves emerged during the time of secondary induction in larger and faster induced plants

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

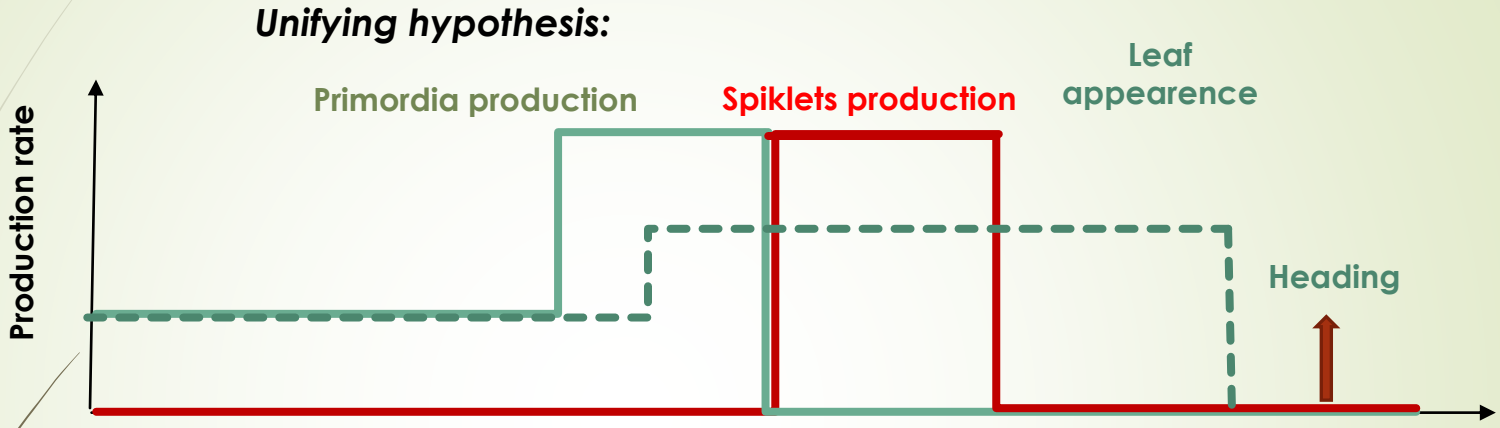
→ **the rate of leaf production increased during secondary induction (by 4 .5)**

→ **The faster the transition occured, the smaller the number of leaves produced**

RESULTS 3. NUMBER OF SPIKELETS



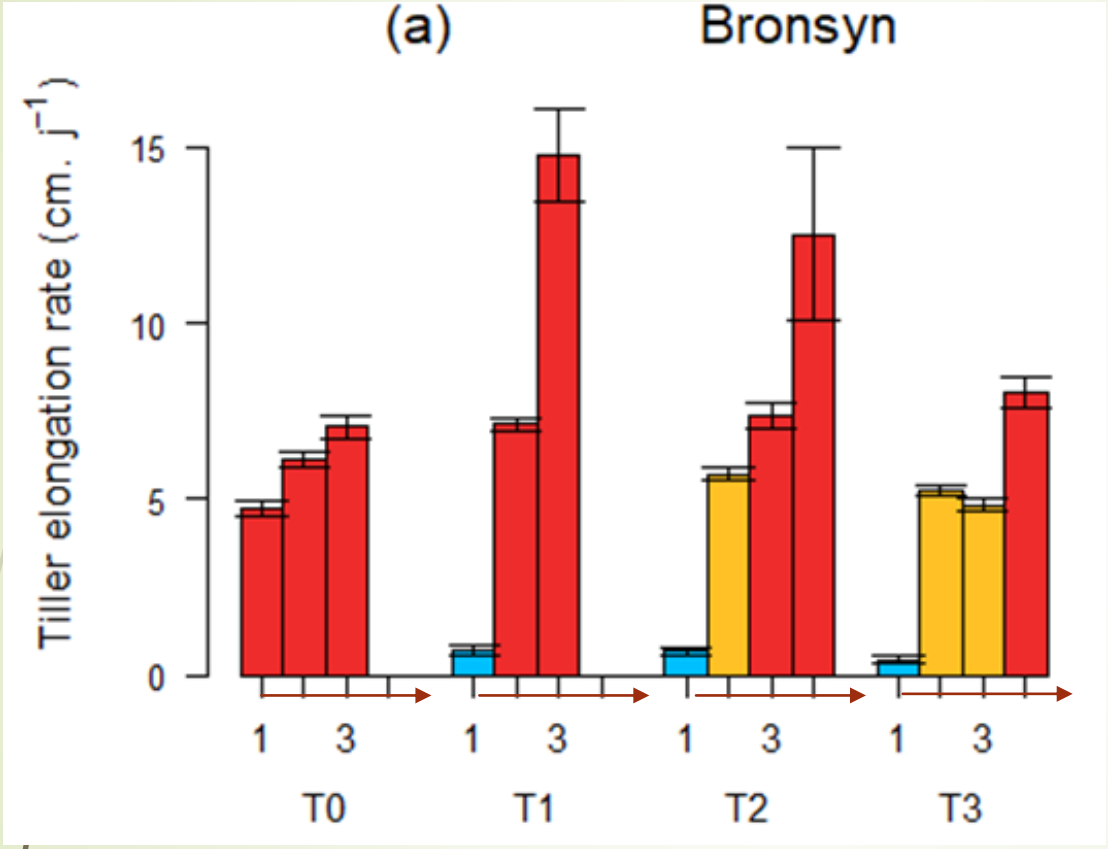
- ***The number of spikelets depended on the number of leaves produced following the beginning of secondary induction***
- ***The longer it took to unfold all leaves, the longer the apex had tor producing spikelets***



- **The hypothetical organ production scheme was consistent with obervations**

- What impacts of secondray induction conditions on leaf elongation rates ?

RESULTS 4. LEAF ELONGATION RATE PER TILLER

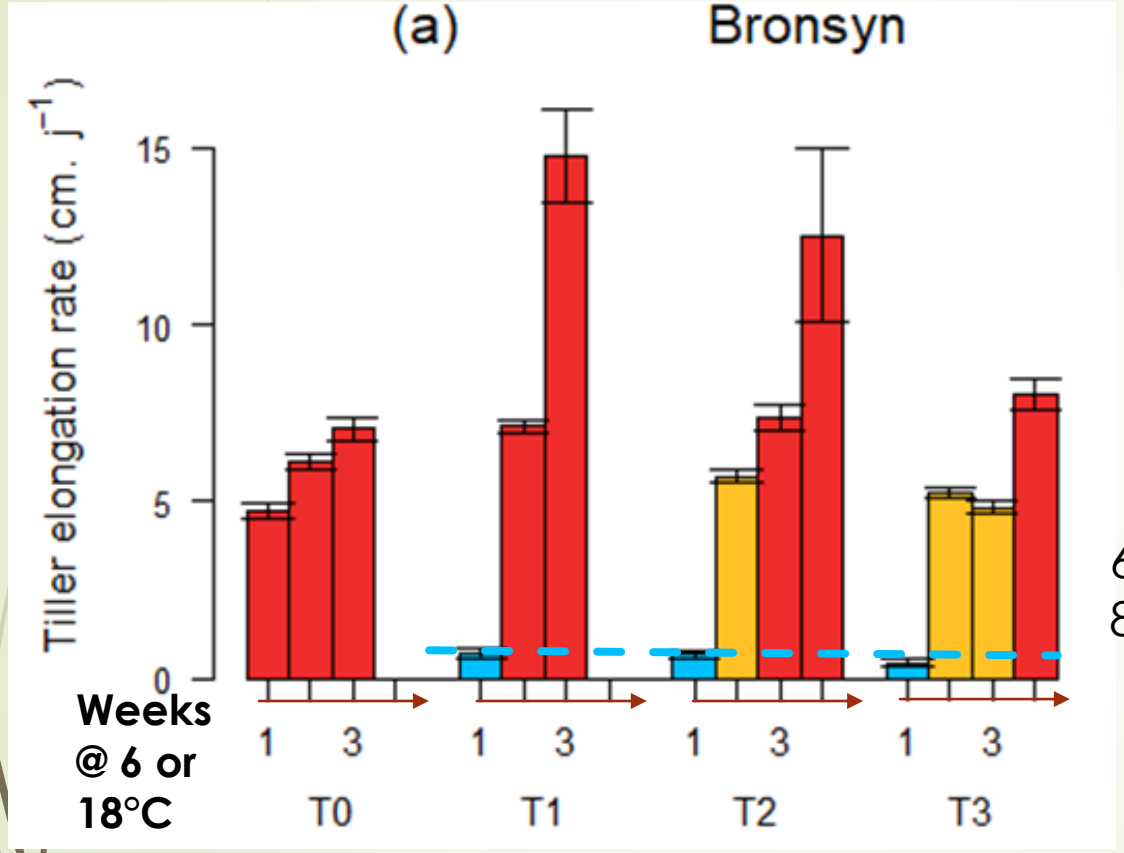


Cold+ short days

Hot + short days

Hot + long days

RESULTS 4. LEAF ELONGATION RATE PER TILLER

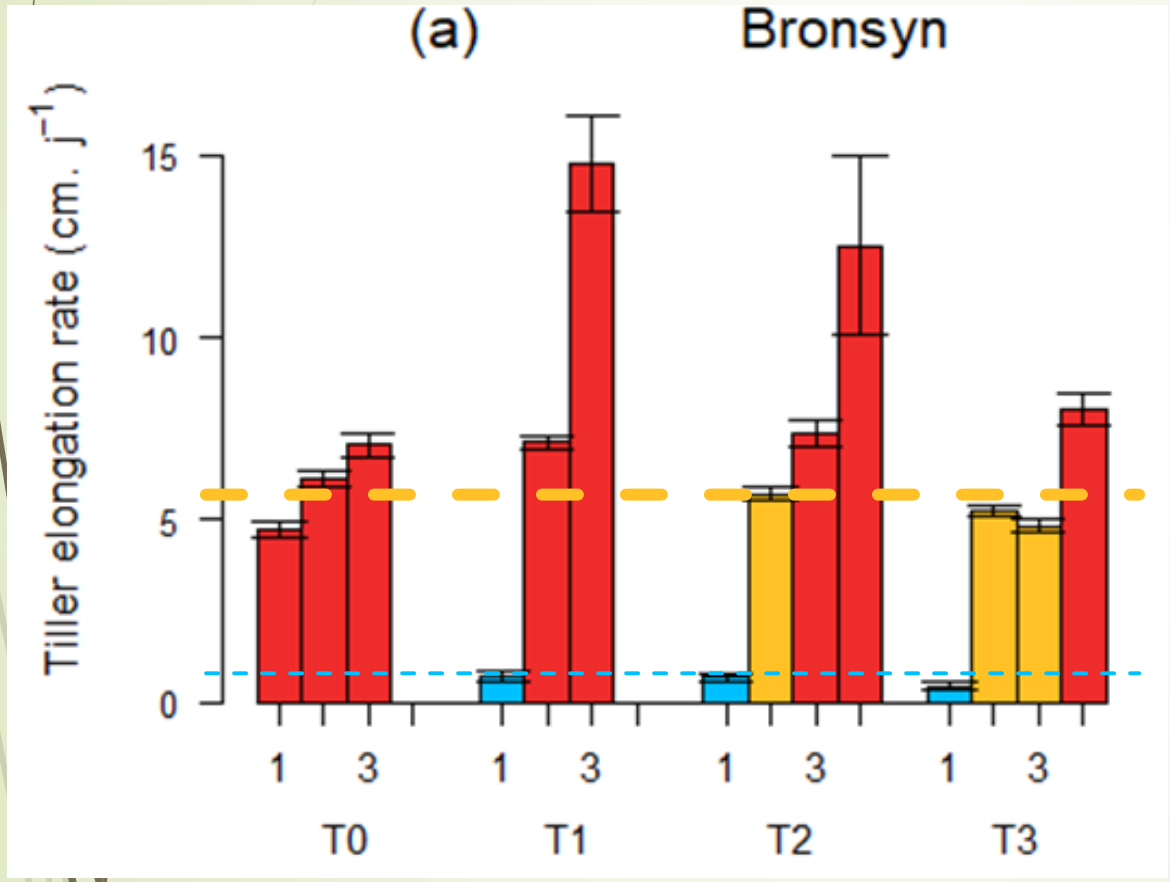


6°C + 8h

18°C+ 8h

18°C+ 16h

RESULTS 4. LEAF ELONGATION RATE PER TILLER



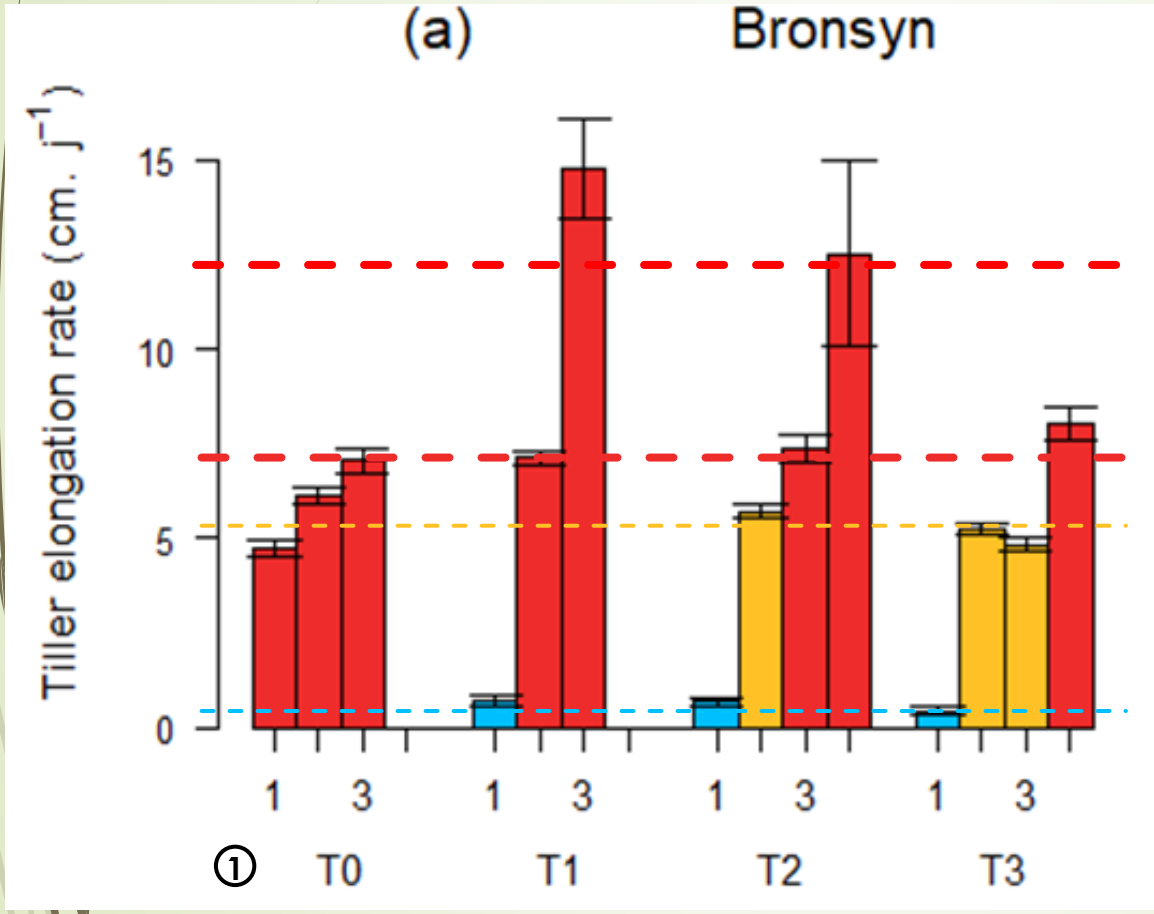
① **TEMPERATURE INCREASE**

6°C + 8h

18°C+ 8h

18°C+ 16h

RESULTS 4. LEAF ELONGATION RATE PER TILLER

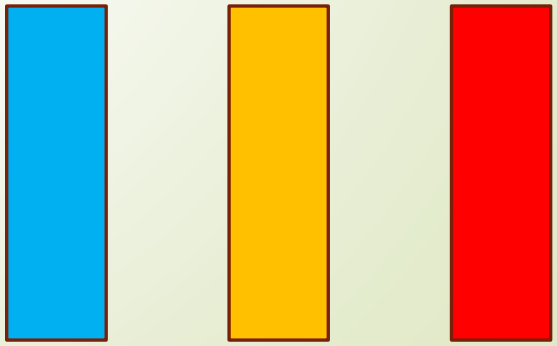


② **GRADUAL IMPACT OF INCREASED DAY LENGTH**

6°C + 8h

18°C+ 8h

18°C+ 16h



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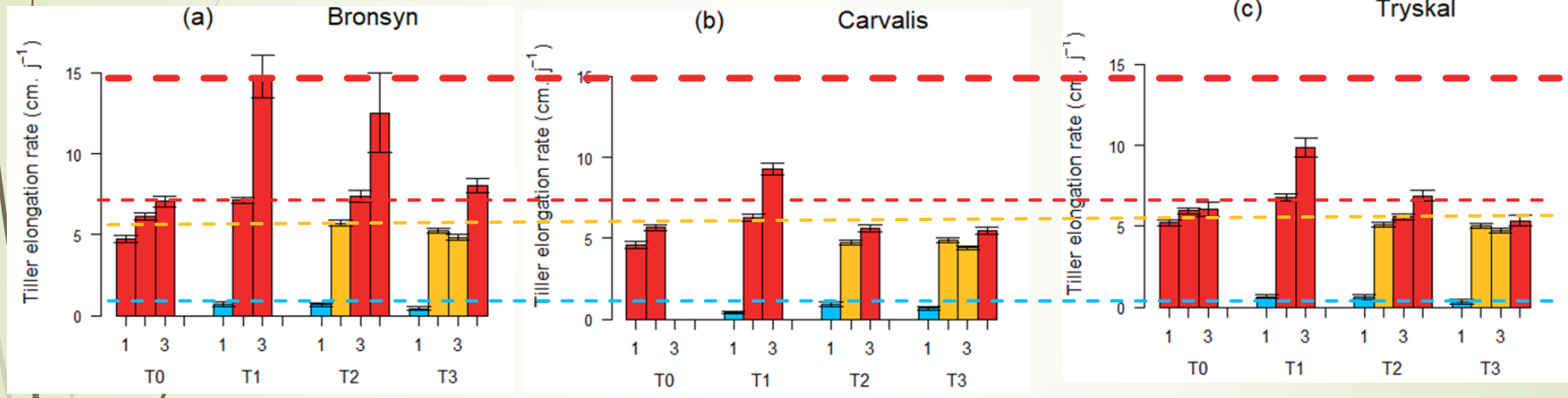

① **TEMPERATURE INCREASE**

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 the new model L-Grass F, 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/