

Timing Matters: Variability of Drought Effects on Phenology and Growth in Goat Willow (*Salix caprea* L.)

DANI
DOKTORATA
BIOTEHNIČKOG
PODRUČJA

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Introduction

Phenological processes

Spring

Autumn

budburst

flowering

leaf
senescence

Phenological
factors

typical

Chilling
temperature

Spring
temperature

Photoperiod

drought

Pests (defoliation
induced reaction)

Elevated ozone
concentrations

Nutrient
variations in soil

atypical



Introduction

- Drought as a driver of phenological processes:
 - reduced height growth, delayed or advanced budburst in spring, and leaf senescence in autumn (Hinckley et al. 1979; Xie et al. 2015; Čehulić et al. 2019; Wu et al. 2022)
 - The **carry-over effect** (memory effect?) manifests through later or earlier budburst in the following spring (phenological shifts)
- most relevant studies have focused on the impact of single drought stress on leaf phenology, i.e., drought stress induced at a specific time during the growing season (Spieß et al. 2012; Kuster et al. 2014; Vander Mijnsbrugge et al. 2016)



Introduction

- The aim of the study:
 - a) answer the question of whether there are variations in the effects of drought stress when stress is induced at different times during the growing season
 - b) to determine the impact of the mentioned stress on height growth, spring and autumn leaf phenology, and flower formation in the goat willow clone

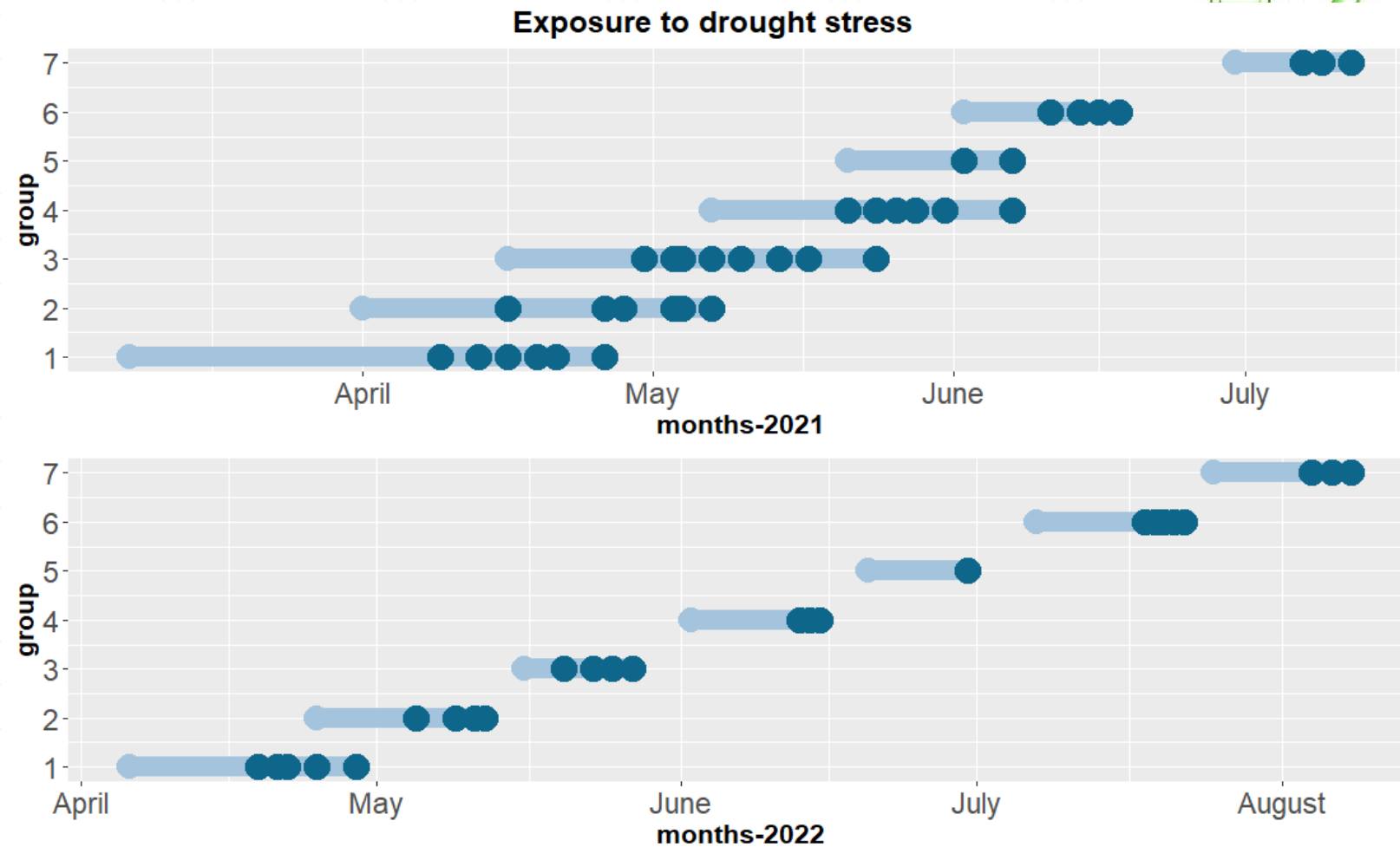


Material and methods



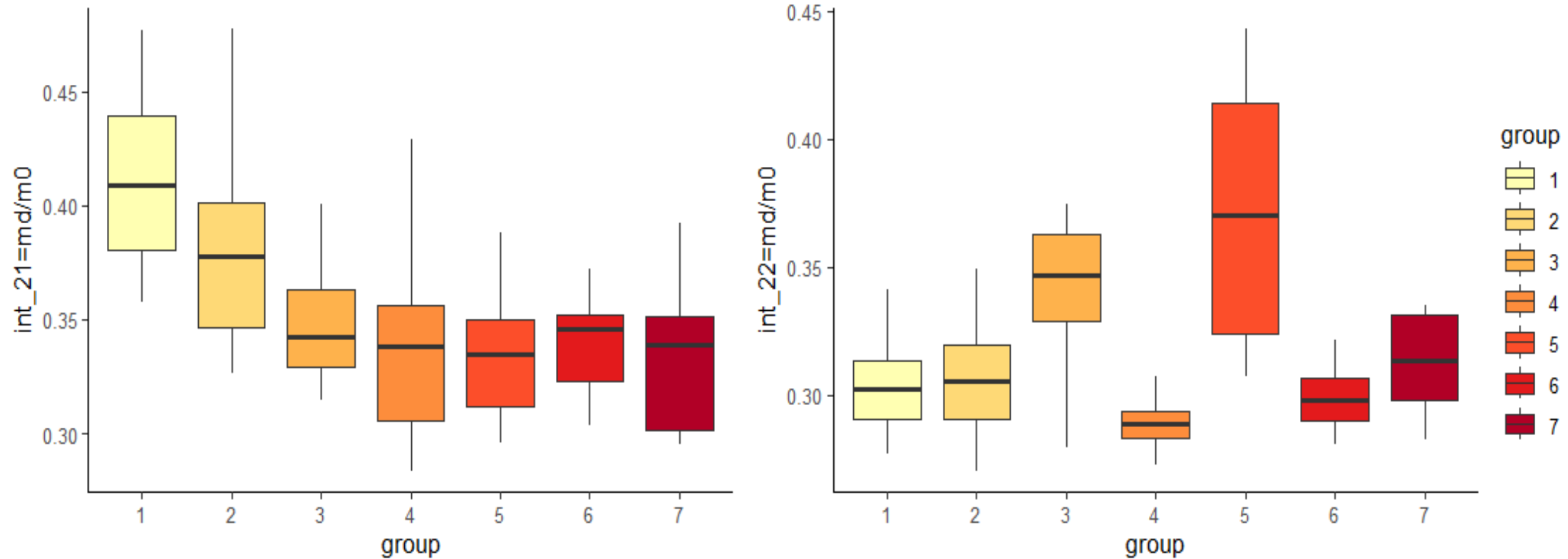
Material and methods

- 1
- 2
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- 7
- Control group





Intensity of drought stress based on ramet mass loss



Proportion of mass at the end of drought treatment (upon the appearance of visible symptoms) relative to the initial mass (plant mass with container) by groups. Int21 - mass ratio in 2021; Int22 - mass ratio in 2022.

Measurements and Scoring

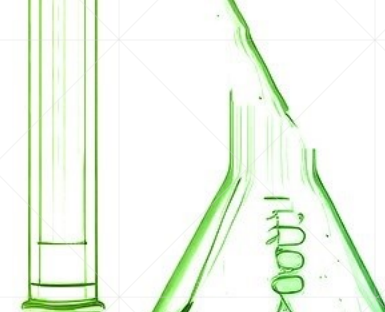
Spring leaf phenology:

- Leaf phenology was monitored for all plants in the experiment using an ordinal scale of 1-7



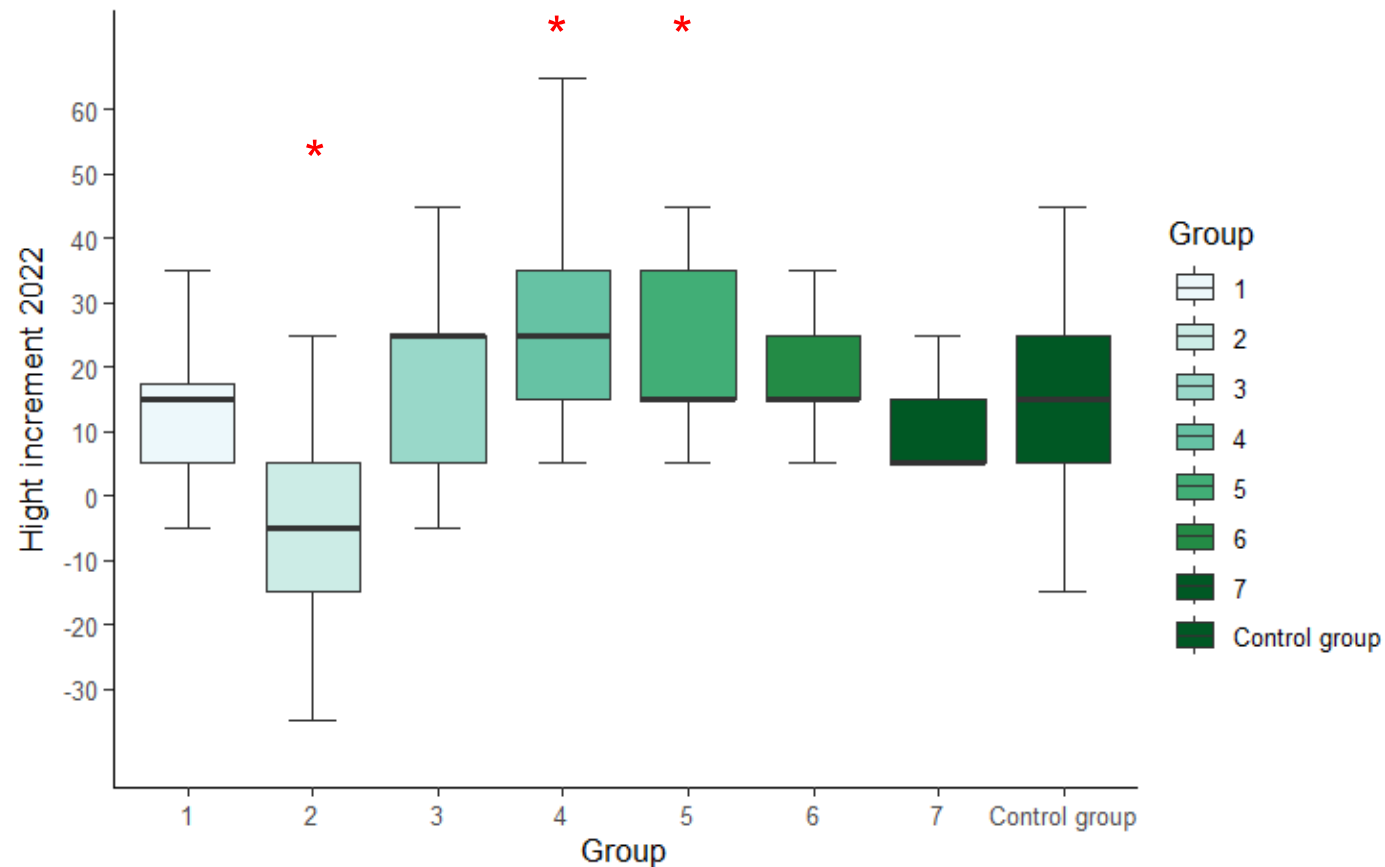
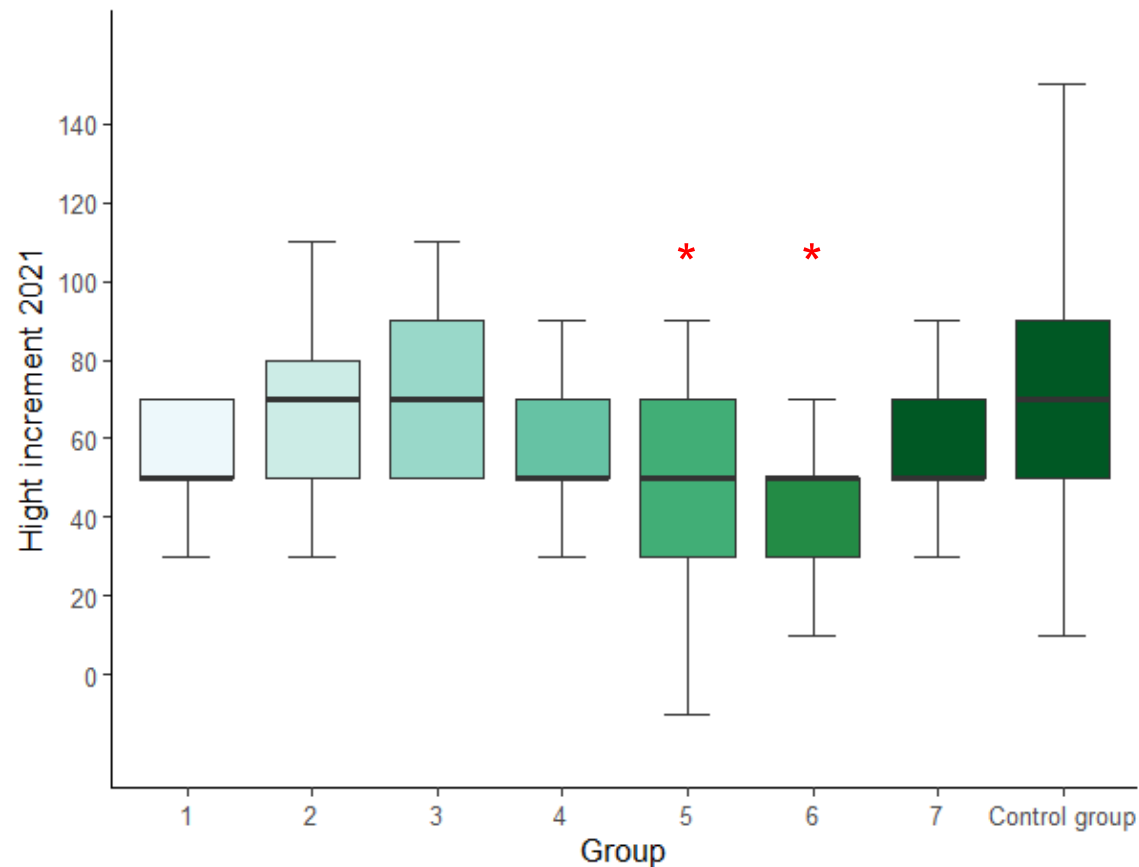
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Measurements and Scoring



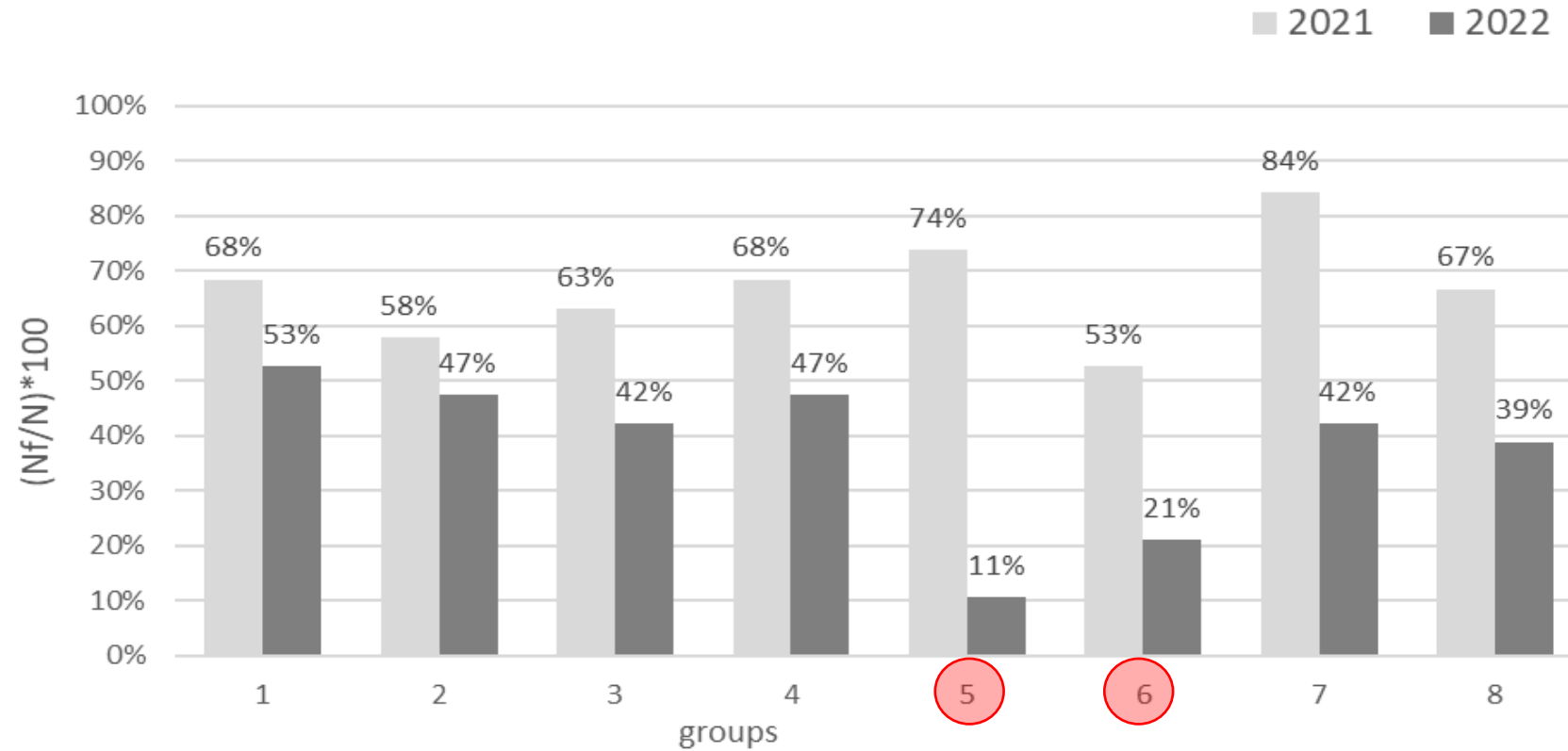


The impact of drought on height growth

The distribution of height increment



The impact of drought on the formation of female flowers

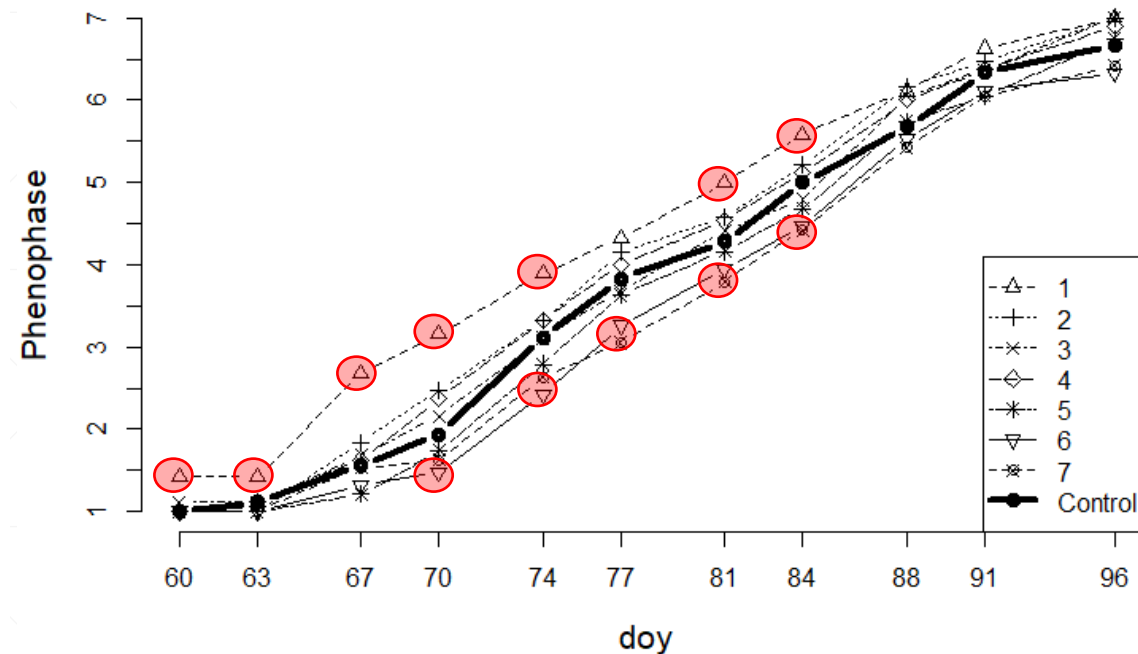
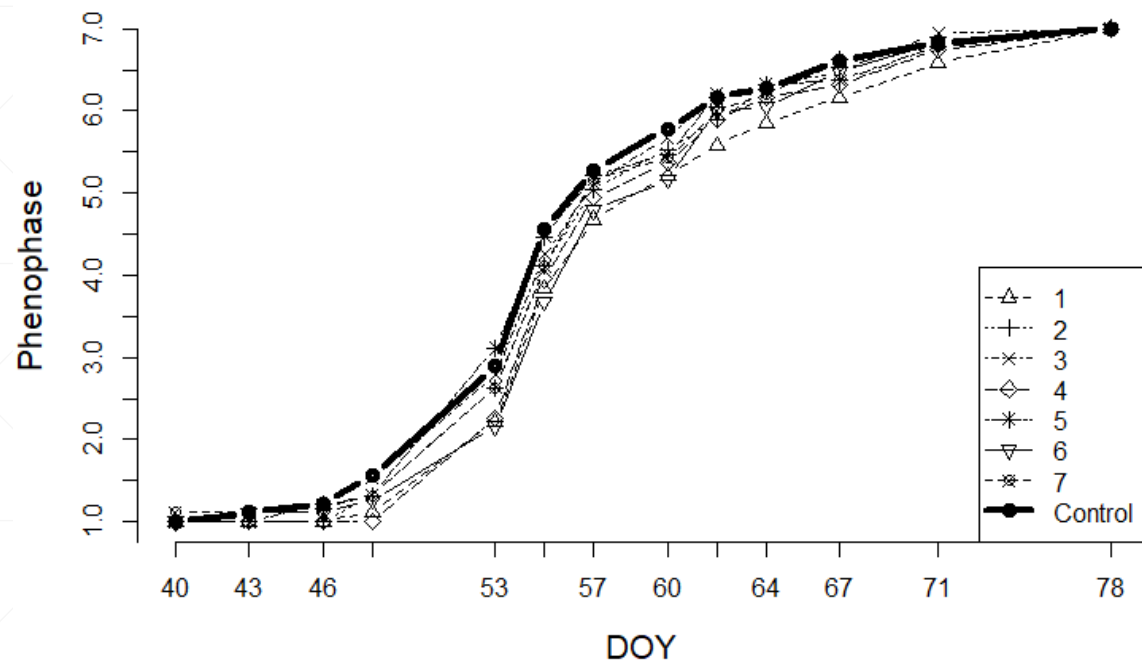


The proportion of plants that have developed flowers (Nf) compared to the total number of plants (N) per group for the year preceding drought stress (2021) and after drought stress (2022).



Autumn Phenology





Conclusion

1. The goat willow ramets responded to drought stress, and the responses varied depending on the timing of drought induction
2. Different timings of drought induction affect various plant responses, including shifts in leaf phenology, positive or negative impacts on height growth, and flower formation
3. Drought stress induced at the beginning of the growing season negatively affects height growth, whereas in the summer months, it may have a positive effect on height growth
4. Drought stress in the summer months extends the growing season, increasing the risk of early autumn frosts
5. The exact mechanism influencing phenological responses remains an open question. It is uncertain whether it involves epigenetics, NSC concentration, or other mechanisms, as well as combinations of multiple mechanisms.





Thank You !

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