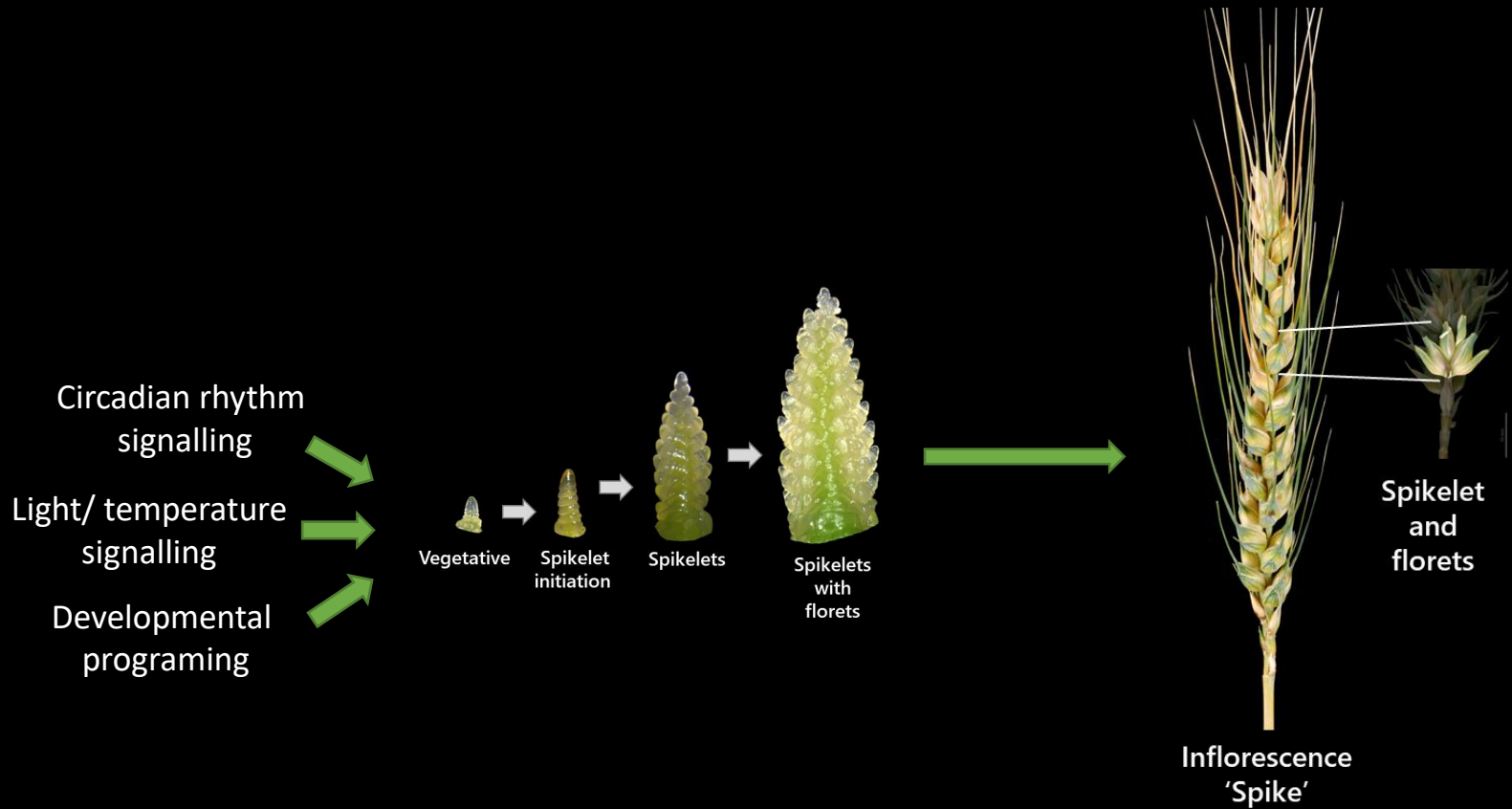


# Temperature robustness in wheat – what can we do to achieve this?

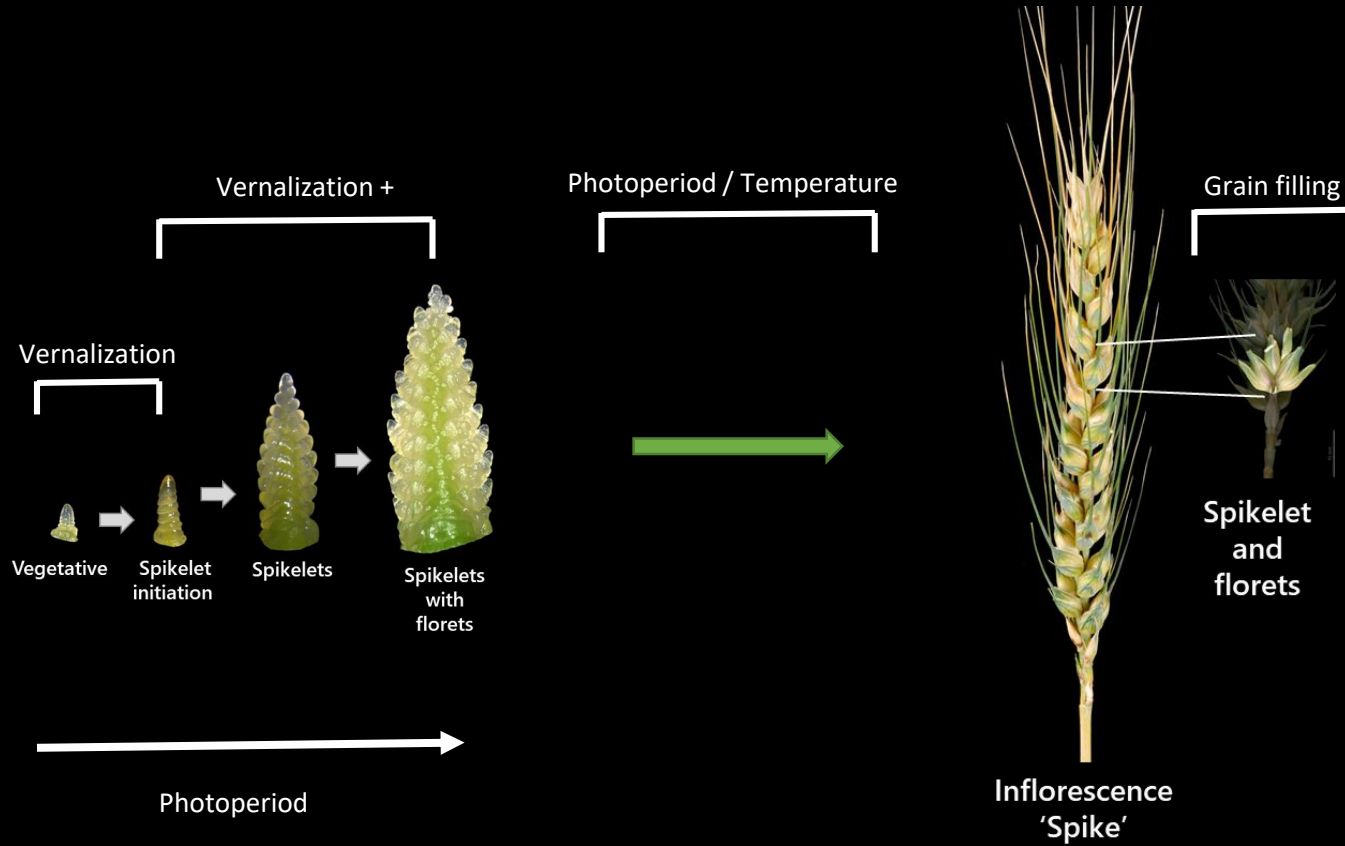
*Laura Dixon*  
*University of Leeds*



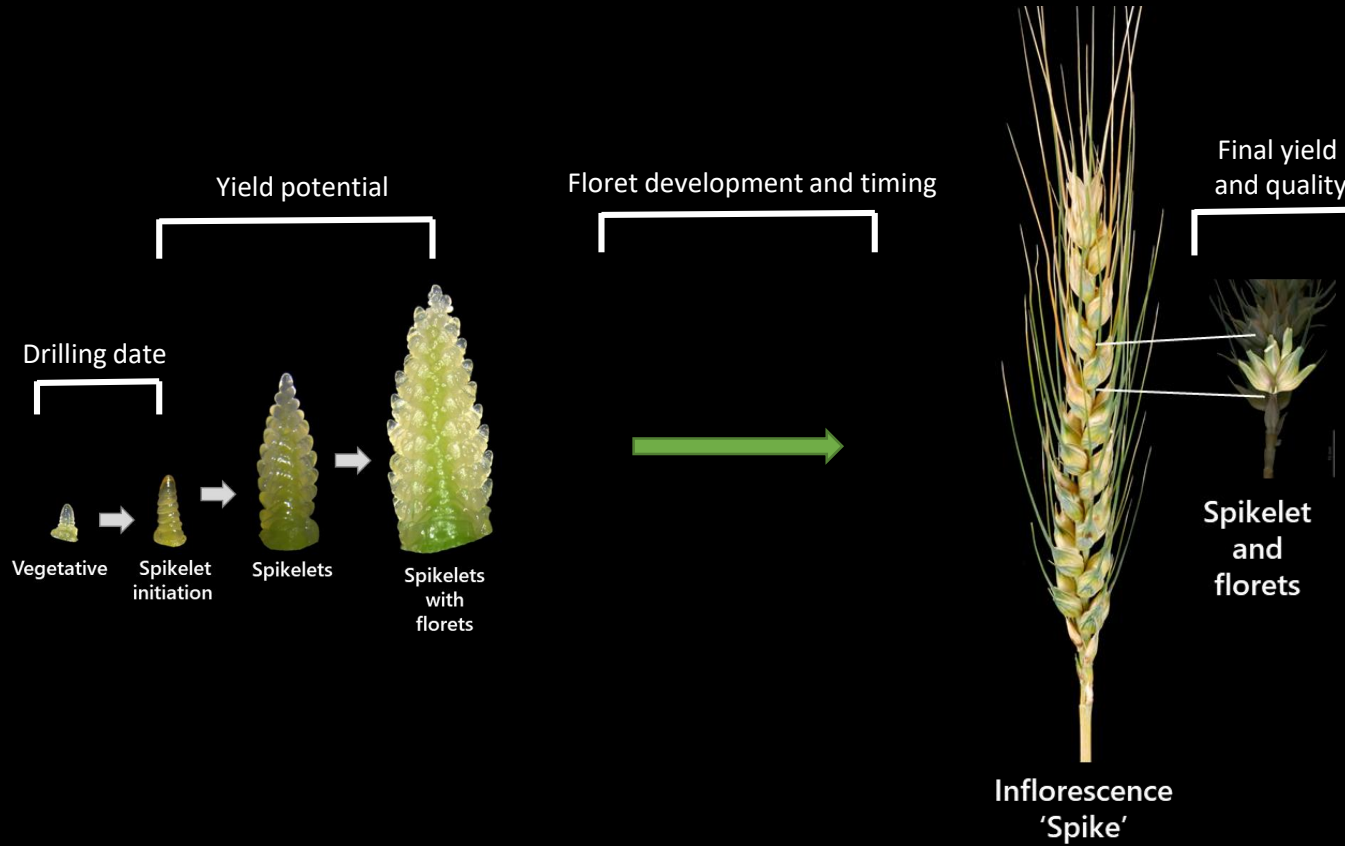
# Floral development



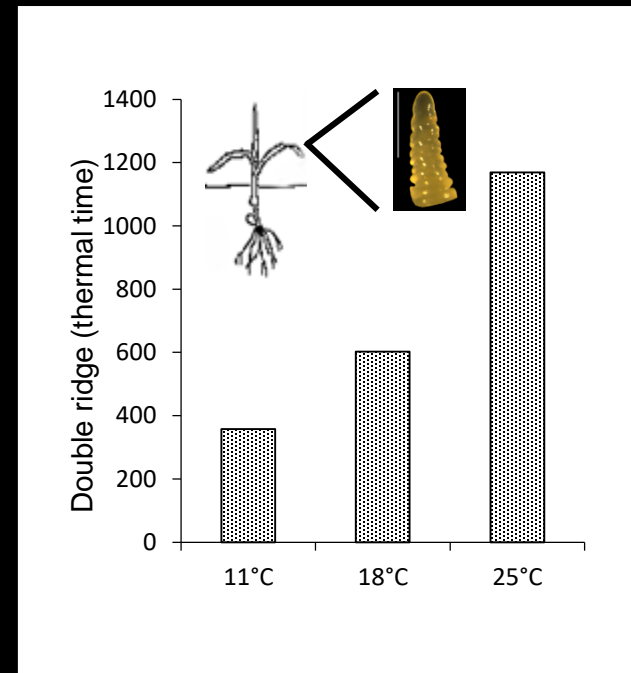
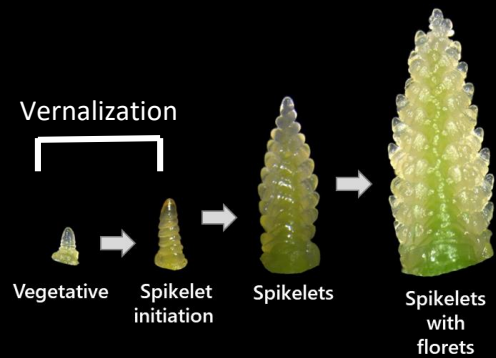
# Floral development



# Floral development

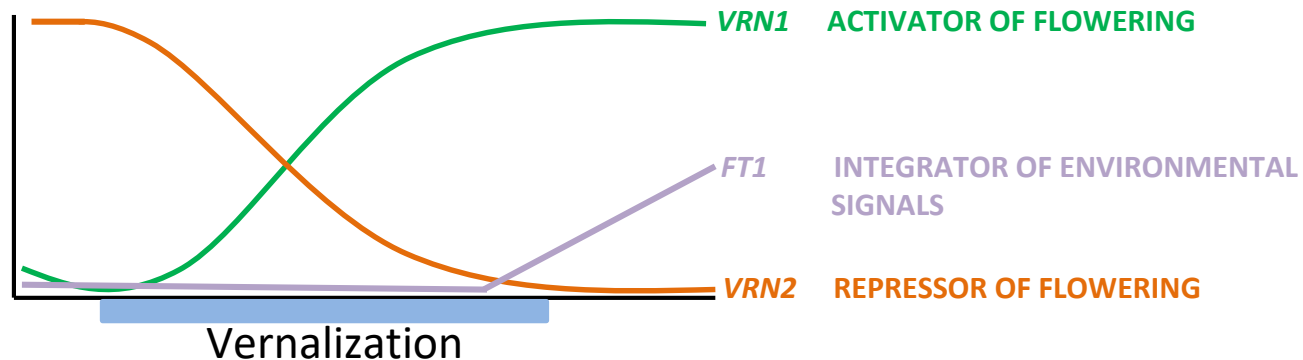


# Vernalization can complete at warmer temperatures



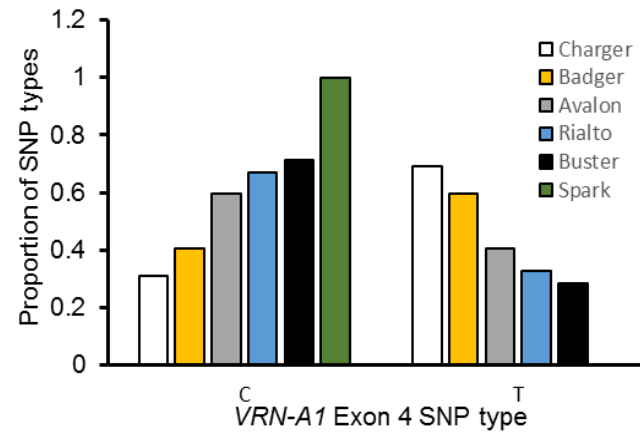
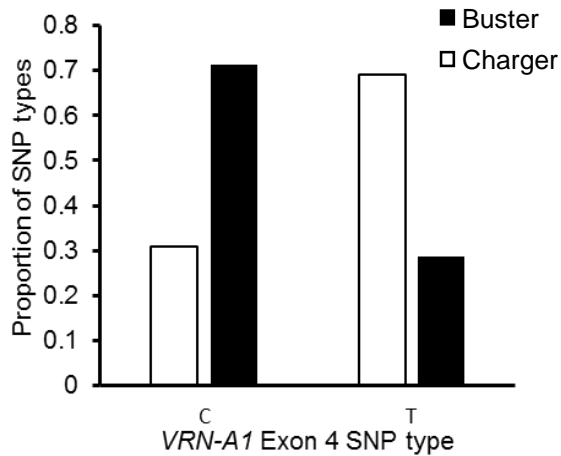
# Dissecting the role of *VRN1*

- Response genetically mapped in Buster x Charger population to 5A... *VRN-A1* but no diagnostic SNP's between Buster and Charger
- Copy number variation

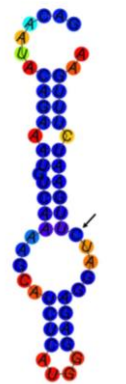


- *VRN1* is an activator of flowering but higher copy number results in longer vernalization requirement  
→ Suggesting that the copies are not equal in functionality

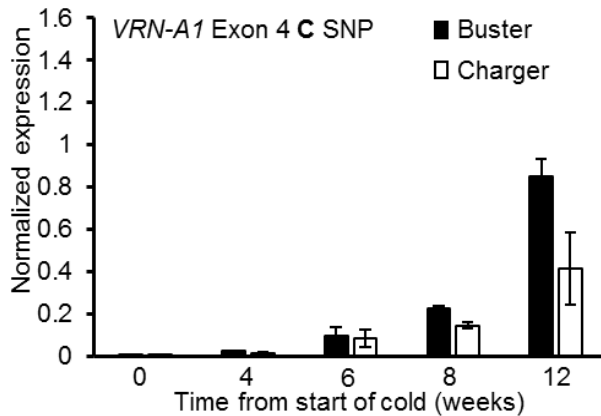
# The type of the copy number of *VRN1* is involved in determining the duration of vernalization required



C-type



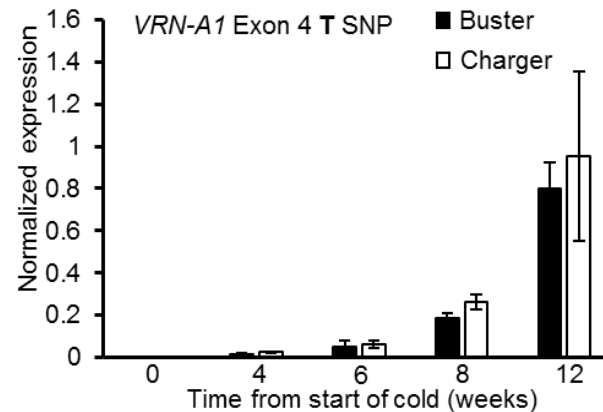
$\Delta G = -11.81$  kcal/mol



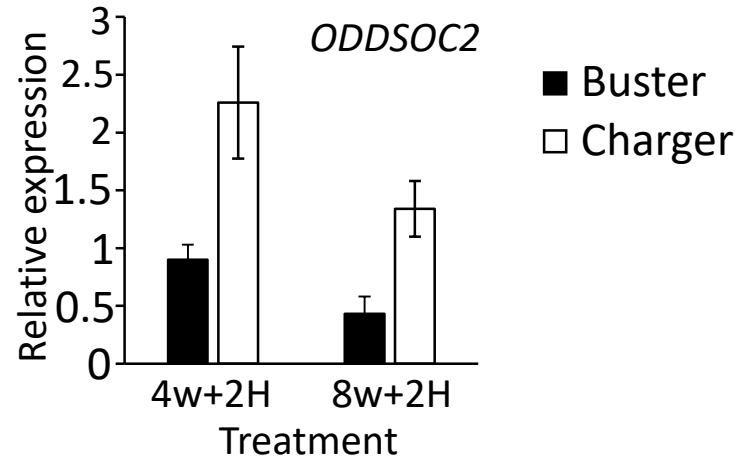
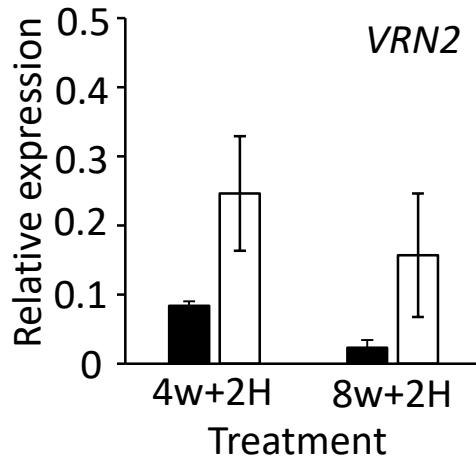
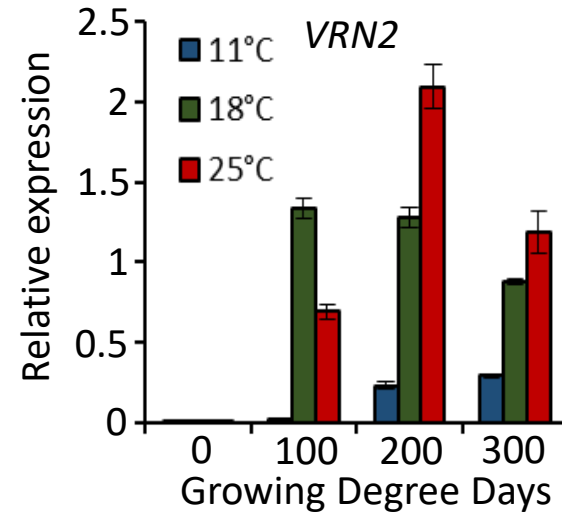
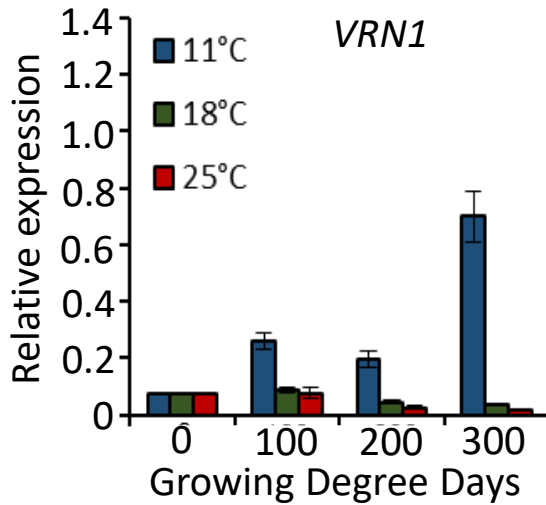
T-type



$\Delta G = -16.08$  kcal/mol

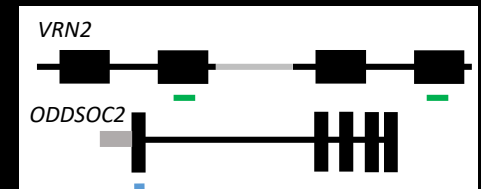
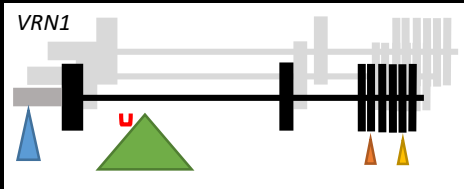
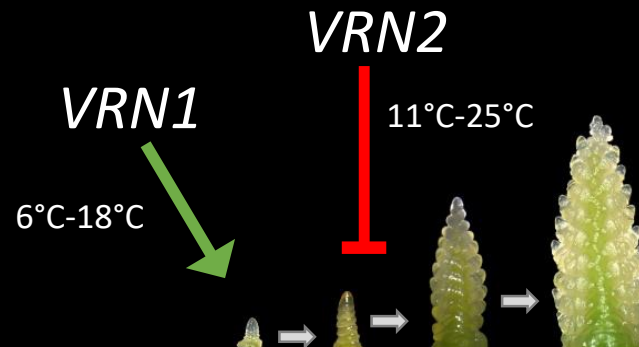


# *VRN2* was regulated by photoperiod And temperature





# Vernalization is responding to a wide temperature range



What happens under variable temperatures?

Is this the only point in apex development these genes have a role?

What about other interacting genes, can we use these as adaptation targets?

# ***What do we need to know?***

- ***How is vernalization controlled in the field?***

Genetic and molecular markers

- ***How can we accelerate vernalization under controlled conditions?***

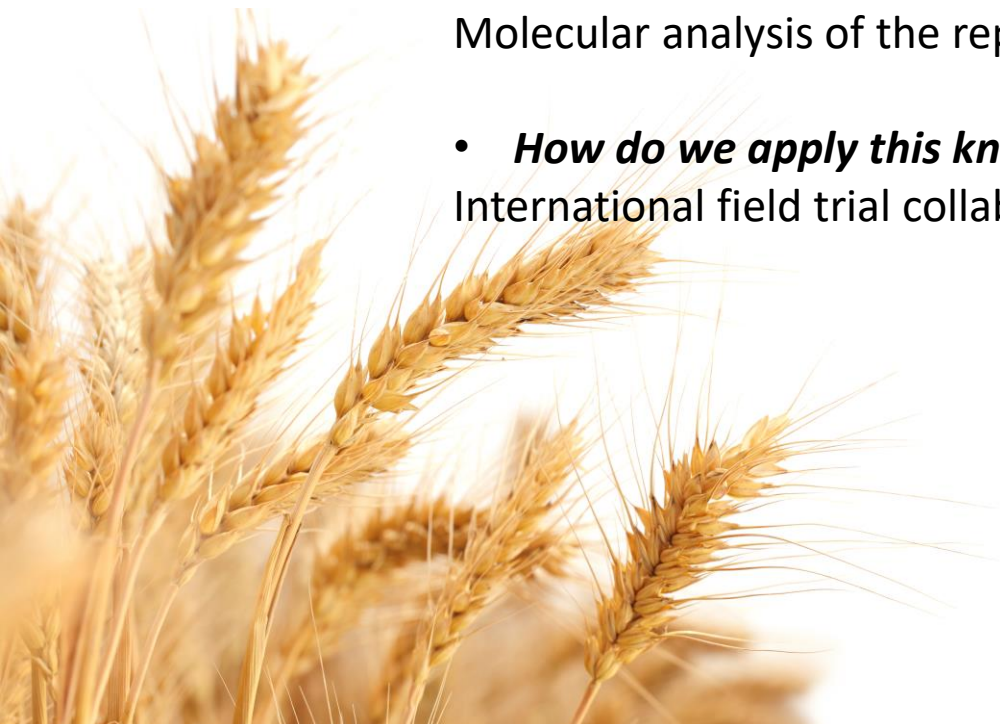
Speed vernalization for scientists and industry

- ***How can we use knowledge about temperature responses to increase wheat yield robustness?***

Molecular analysis of the repressors in spring and winter wheat

- ***How do we apply this knowledge to other countries?***

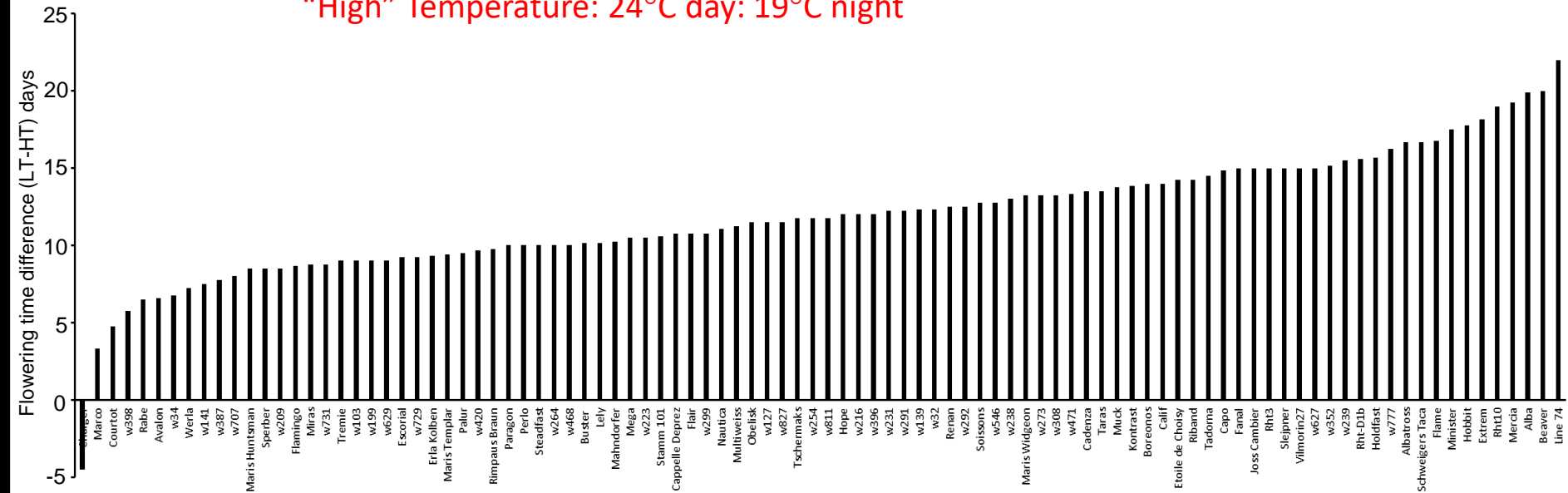
International field trial collaborations



# Regulation of flowering time by ambient temperatures

“Low” Temperature: 18°C day: 13°C night

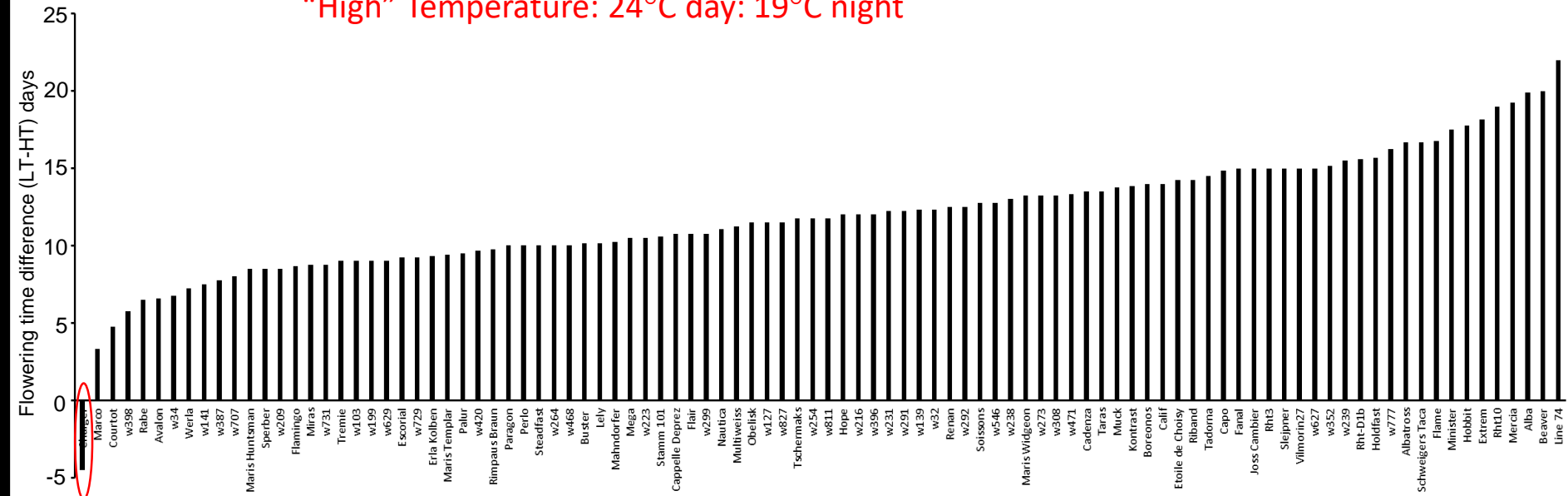
“High” Temperature: 24°C day: 19°C night



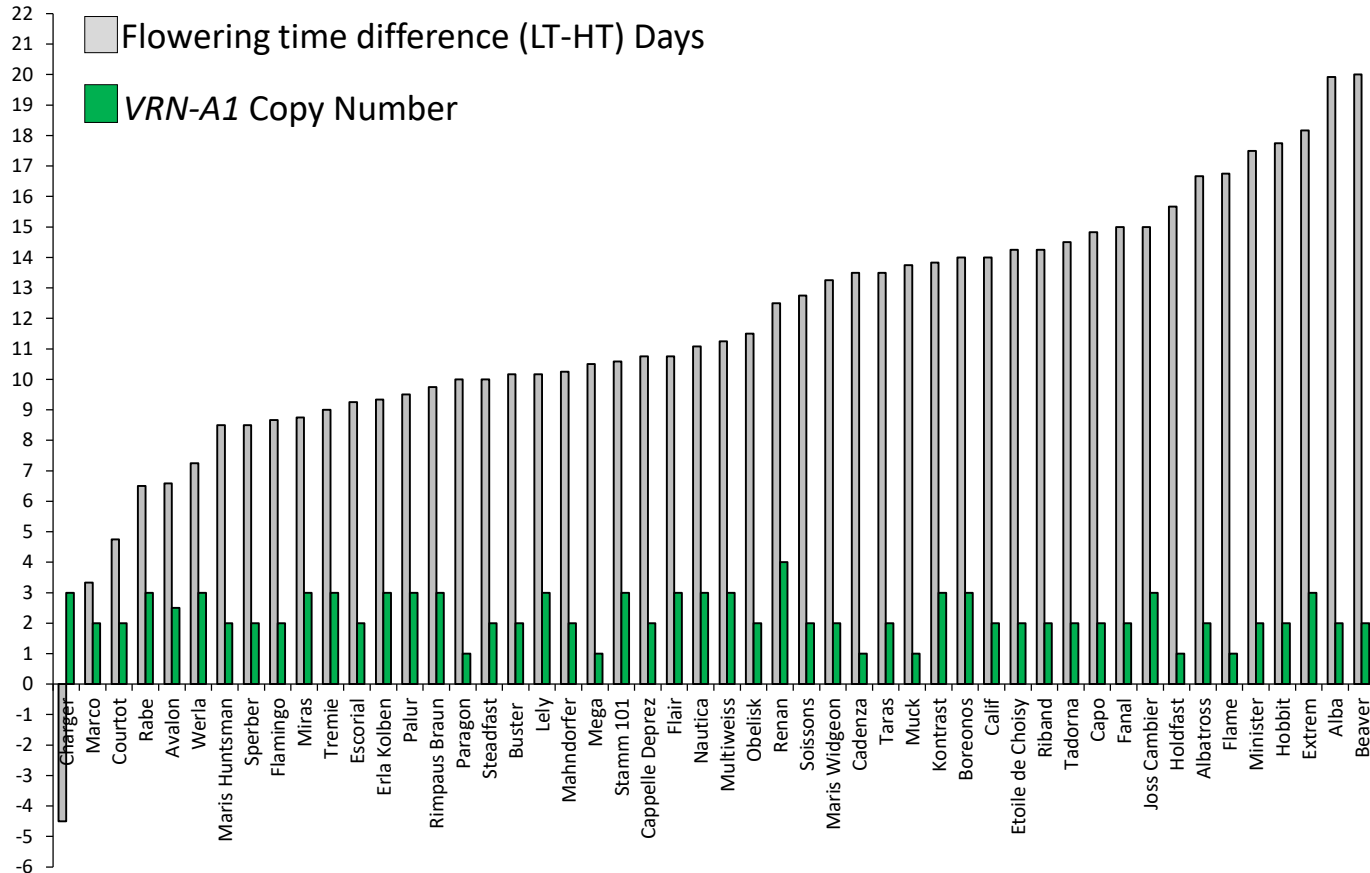
# Regulation of flowering time by ambient temperatures

“Low” Temperature: 18°C day: 13°C night

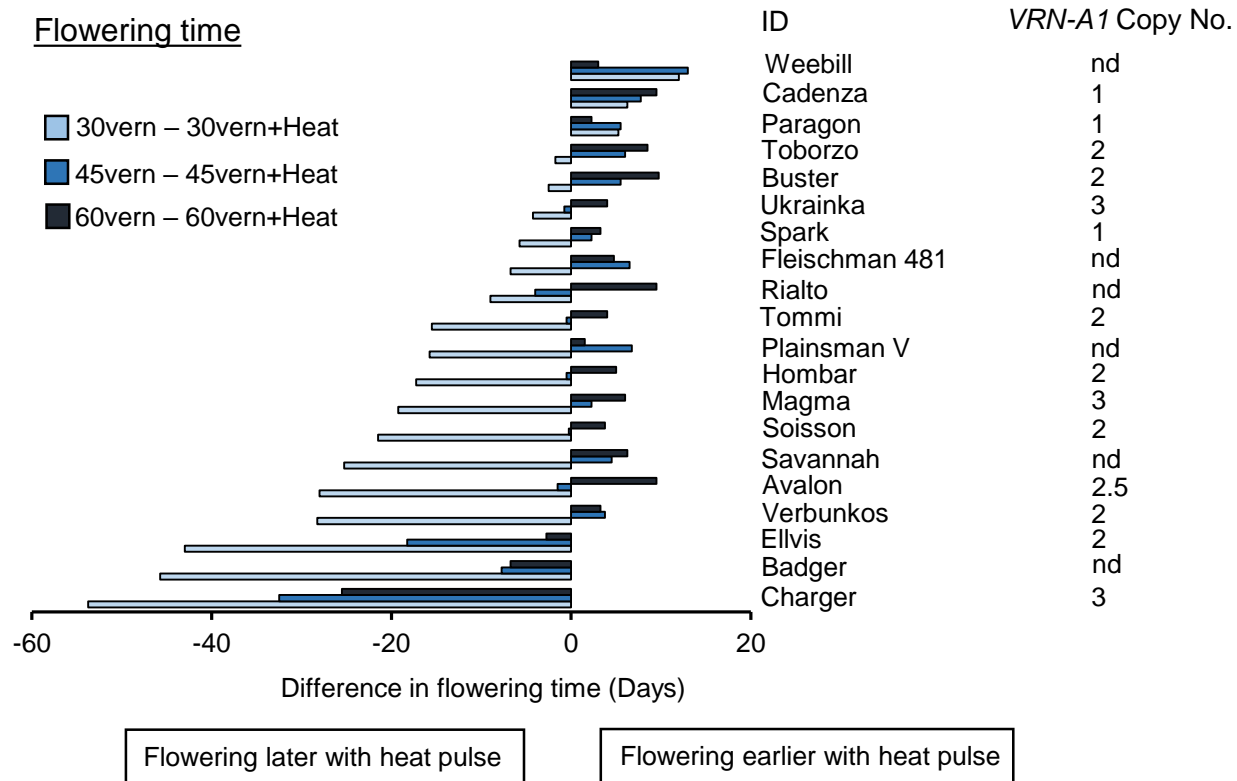
“High” Temperature: 24°C day: 19°C night



# Copy number of *VRN1* is not controlling all of the ambient temperature responses



# Cultivars show distinct responses to warm temperatures



# Summary

- The vernalization process is integrating a range of temperatures
- Some of the warm temperature repressors may have adaptive function in wheat development
- There is a large range of temperature adaptation, beyond vernalization, which we have not investigated

# Acknowledgements

The Lab so far...

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Scott Boden (JIC)

Simon Griffiths (JIC)

Cristobal Uauy (JIC)

I'm recruiting – Post-doctoral researcher and PhD student

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