# Role of bud dormancy in flowering time control in winter oilseed rape, and its association with yield stability

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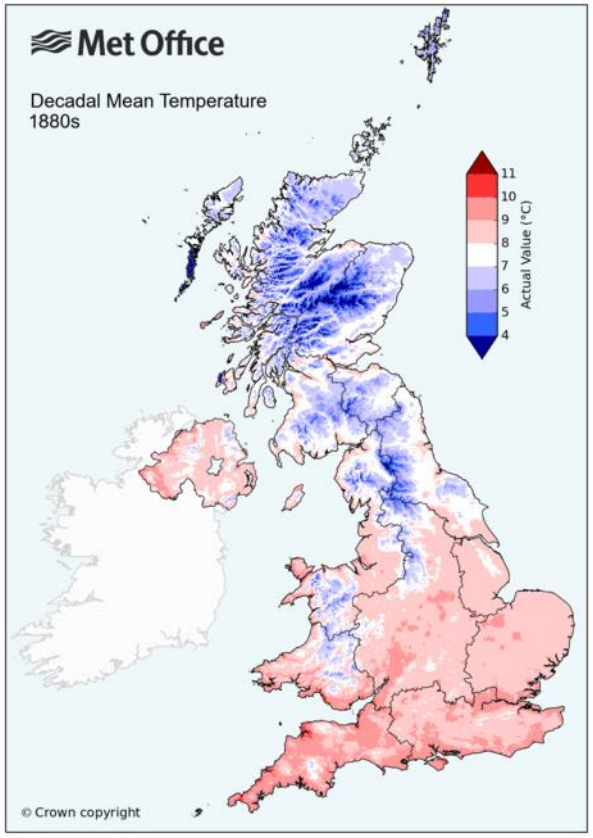
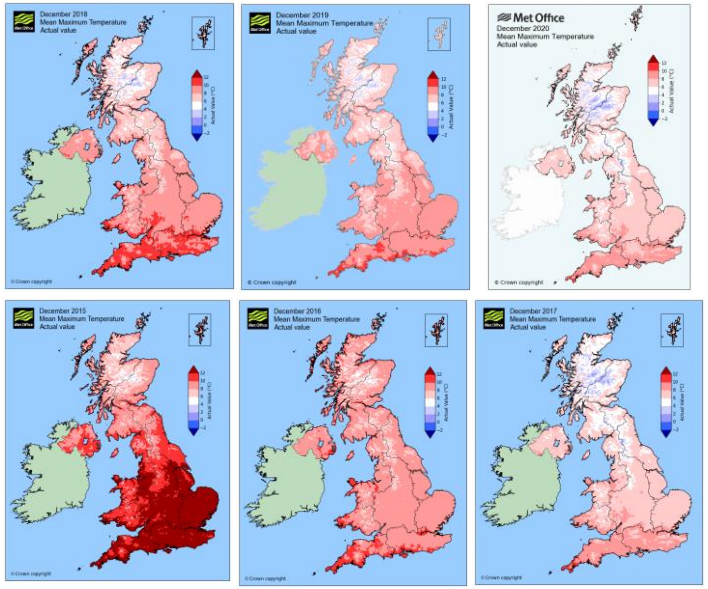
# Climate change is causing warmer winters



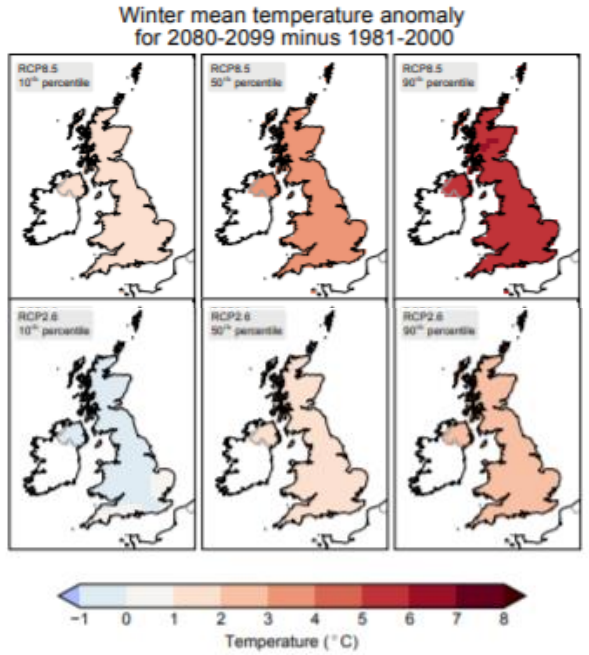

Historic UK climate warming

UK winters face disproportionate warming



Met Office

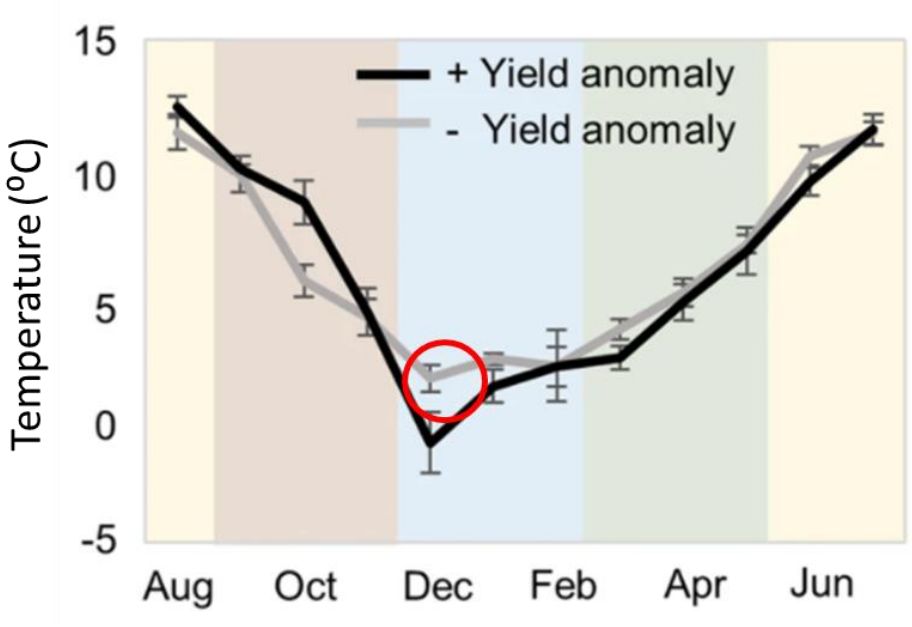
Winters from the past six years




Future winter temperatures

# After the inflorescence transition warm temperatures = reduced yield

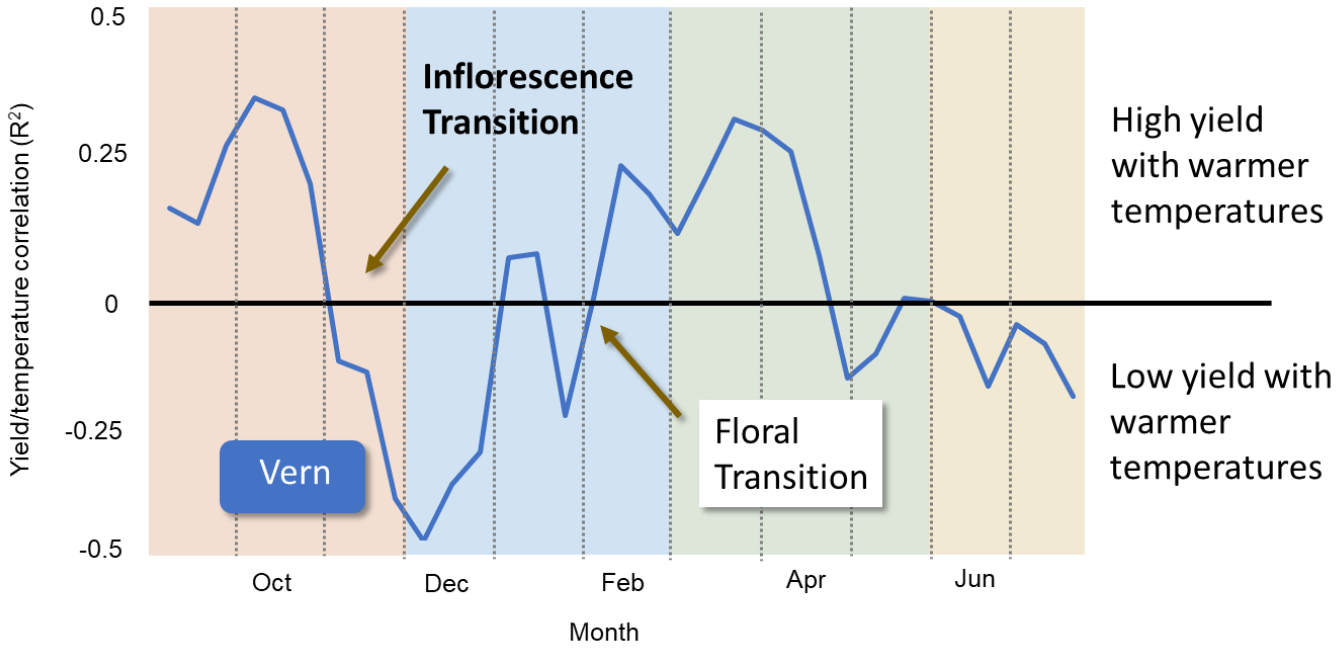
*Brassica napus* yields correlate with winter temperature




£22m

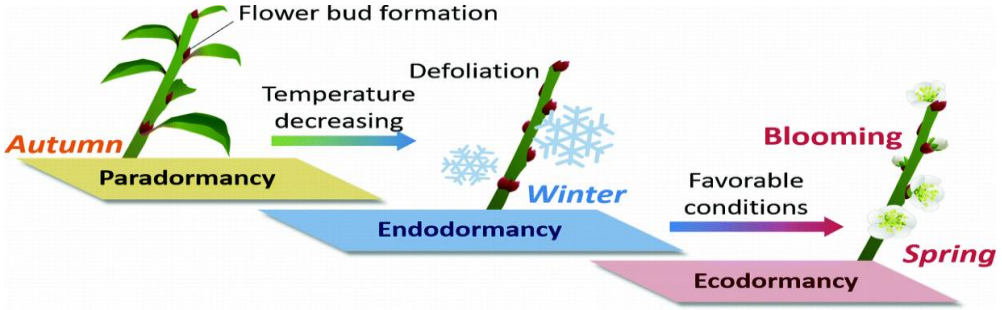
Brown et al., 2019

Warm winter temperatures are negatively associated with yield after the inflorescence transition

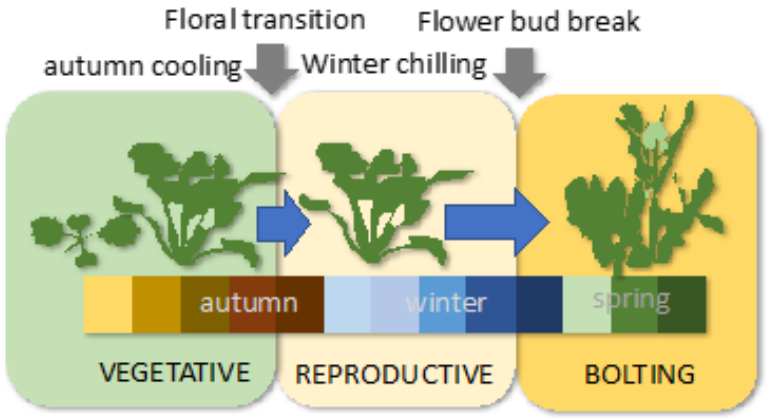


# Winter bud dormancy occurs after the floral transition

This is similar to perennial dormancy model

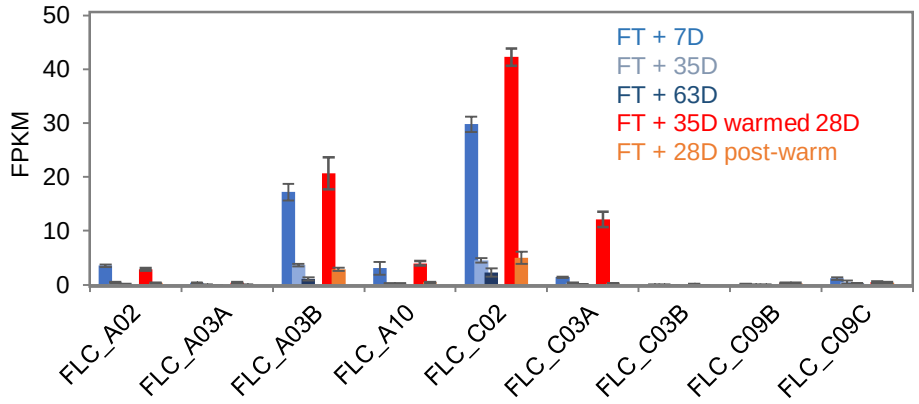



*Brassica napus* model: bud dormancy stage




*B. napus* winter annual phenology hypothesis

We see that warming during this bud dormancy phase alters expression of key genes

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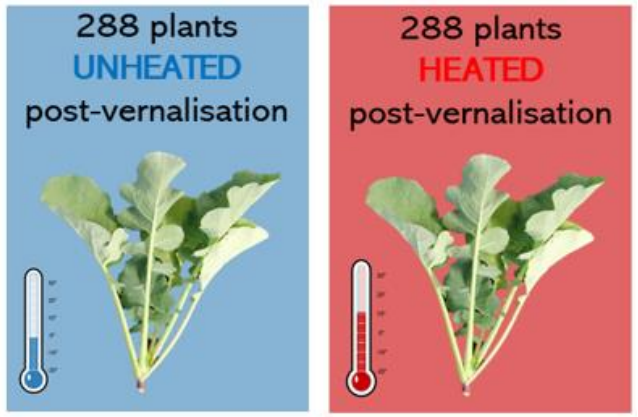
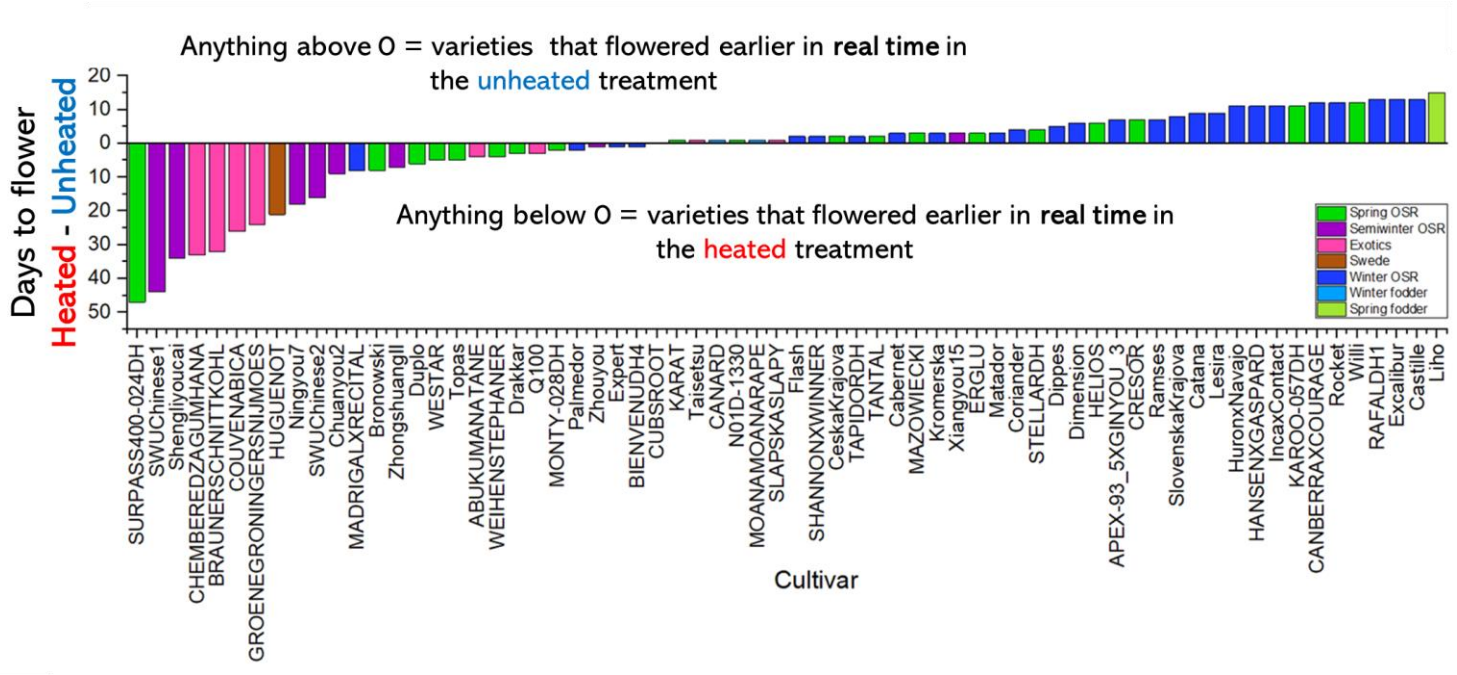
# Warming during bud dormancy delays flowering for many crop varieties



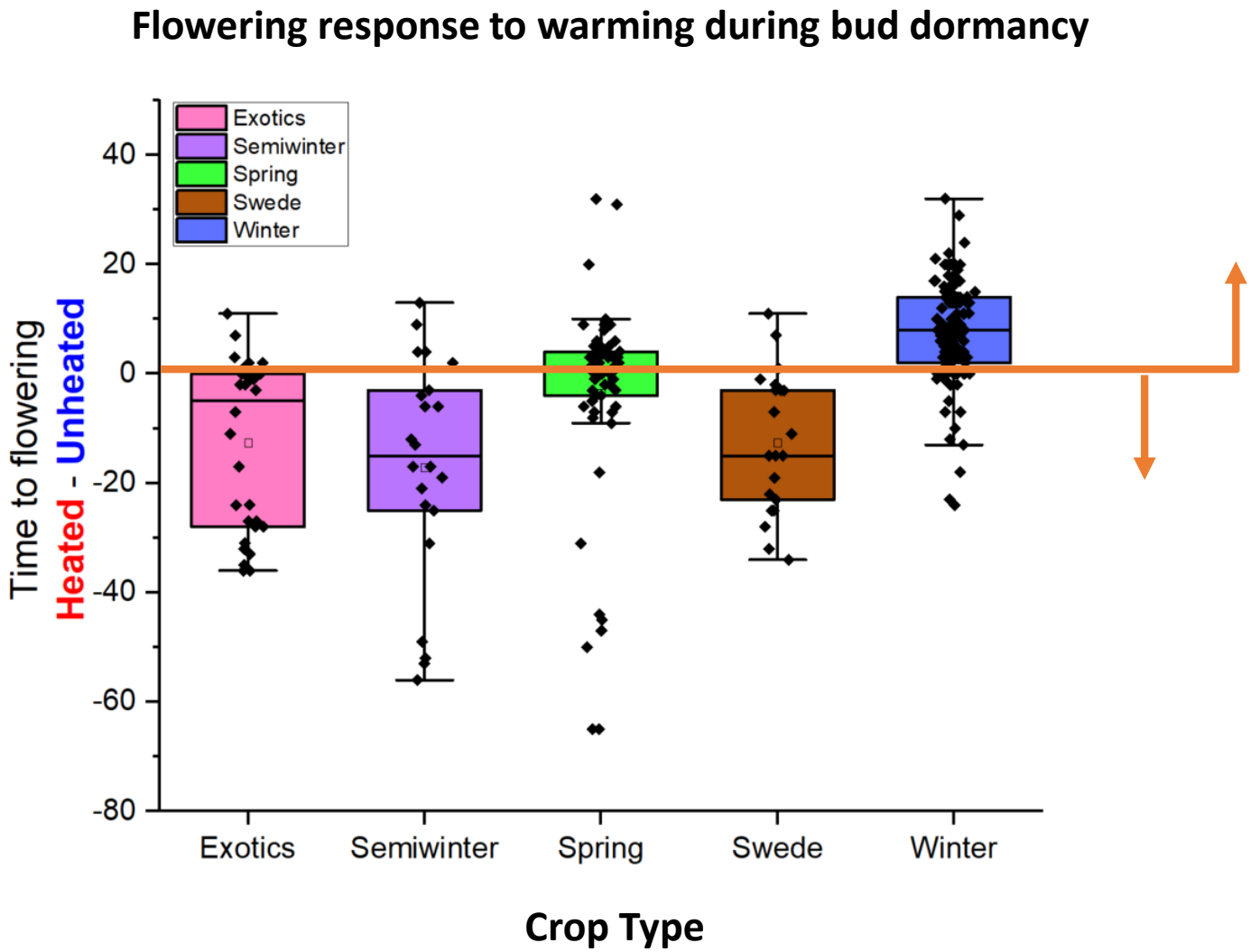

Diversity Fixed Foundation Set including:

Winters, Springs, Swedes, Exotics and Semi-winters.

There is a large range of responses to temperature



# Winter OSR demonstrates delayed flowering in response to warming during bud dormancy

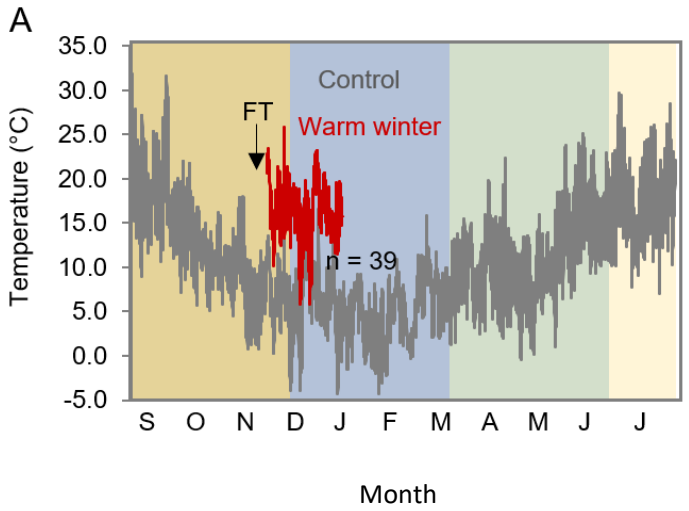



**Delay** to flowering caused by winter warming

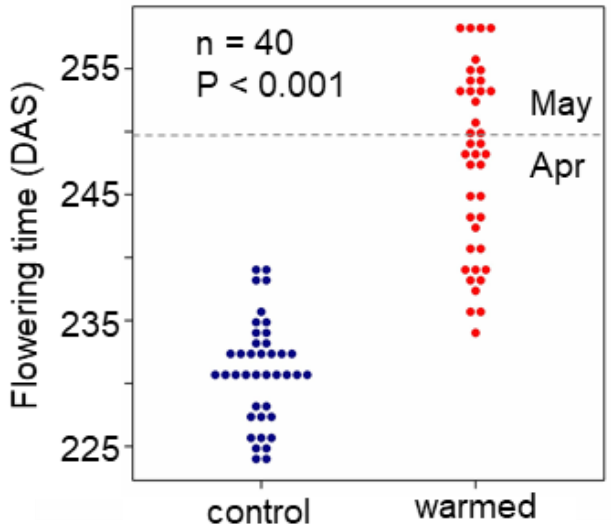
Winter warming **speeds** up flowering

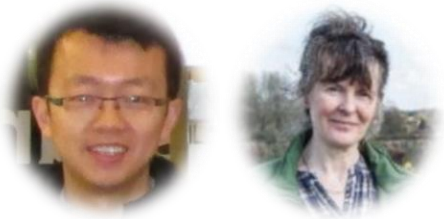
# Warming during bud dormancy delays flowering for Cabriolet

Simulated a rise in winter temperatures in controlled environment rooms




Flowering time delayed by ~14-15 days



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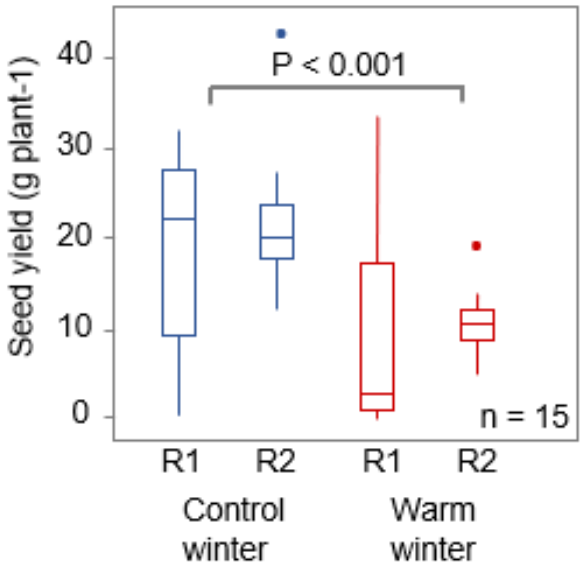
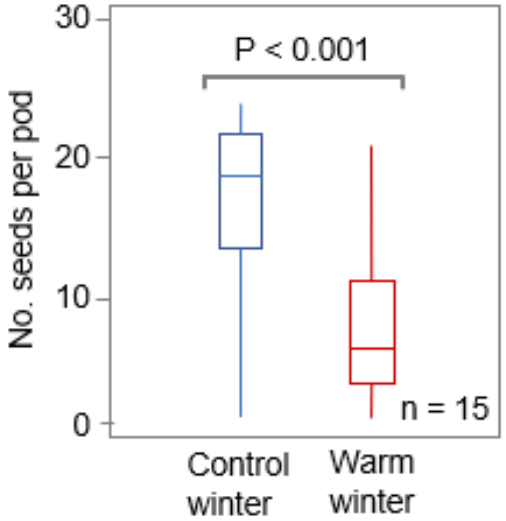
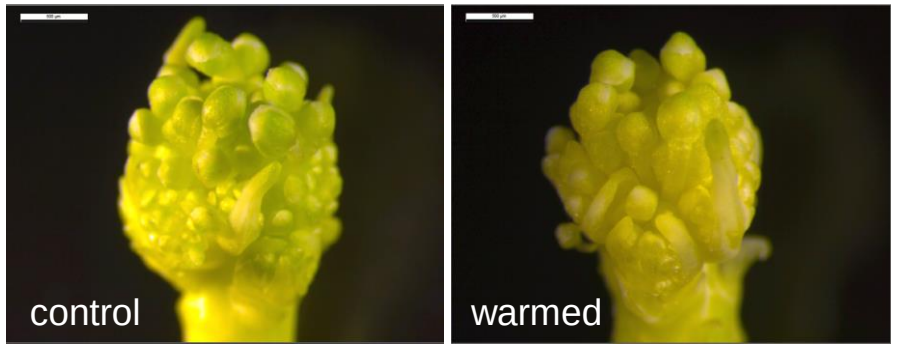
# Delayed heating in Cabriolet is associated with low yield

This is also associated with low yield




Warmed buds also appear  less developed

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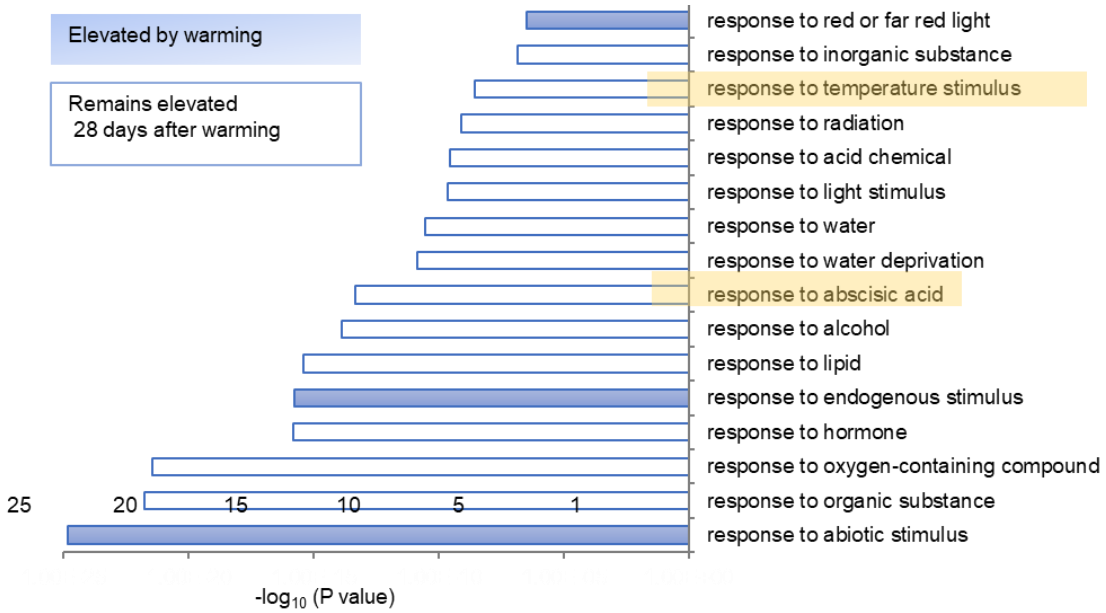
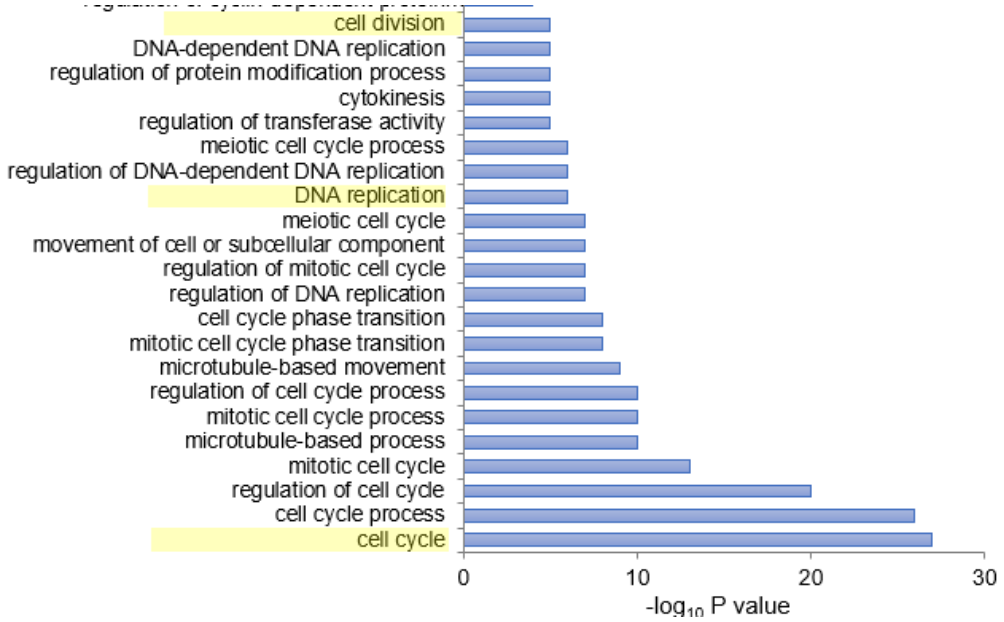
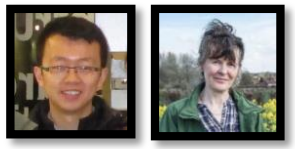
# Warming prevents cell division during bud dormancy

GO Terms in warmed plants show response to ABA and temperature stimulus




GO Terms in control plants show cell division and DNA replication



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# Conclusions

- Warming during bud dormancy:
  - Is associated with low yield
  - Alters gene expression
  - Delays flowering across a wide range of winter OSR
  - Leads to lower yields in Cabriolet
  - Is associated with less cell division


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