Stable flowering dates among pasture legumes are associated with flowering regulation that requires longer vernalisation

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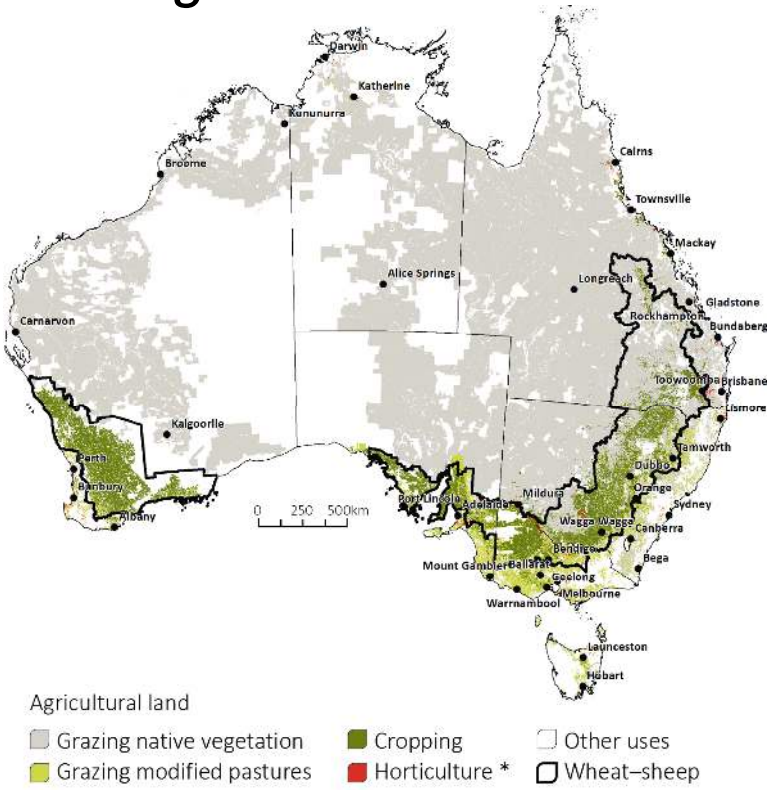
Pasture systems of southern Australia

- The pastures are a mixture of grasses with an annual legume
- Legume provides a cost-effective source of N
- Subterranean clover (*Trifolium subterraneum* L.) is the main legume

  → *highly productive and adapted to a wide range of environments*

Subterranean clover-based pastures grown across 30M ha



Serradellas: alternative pasture legumes

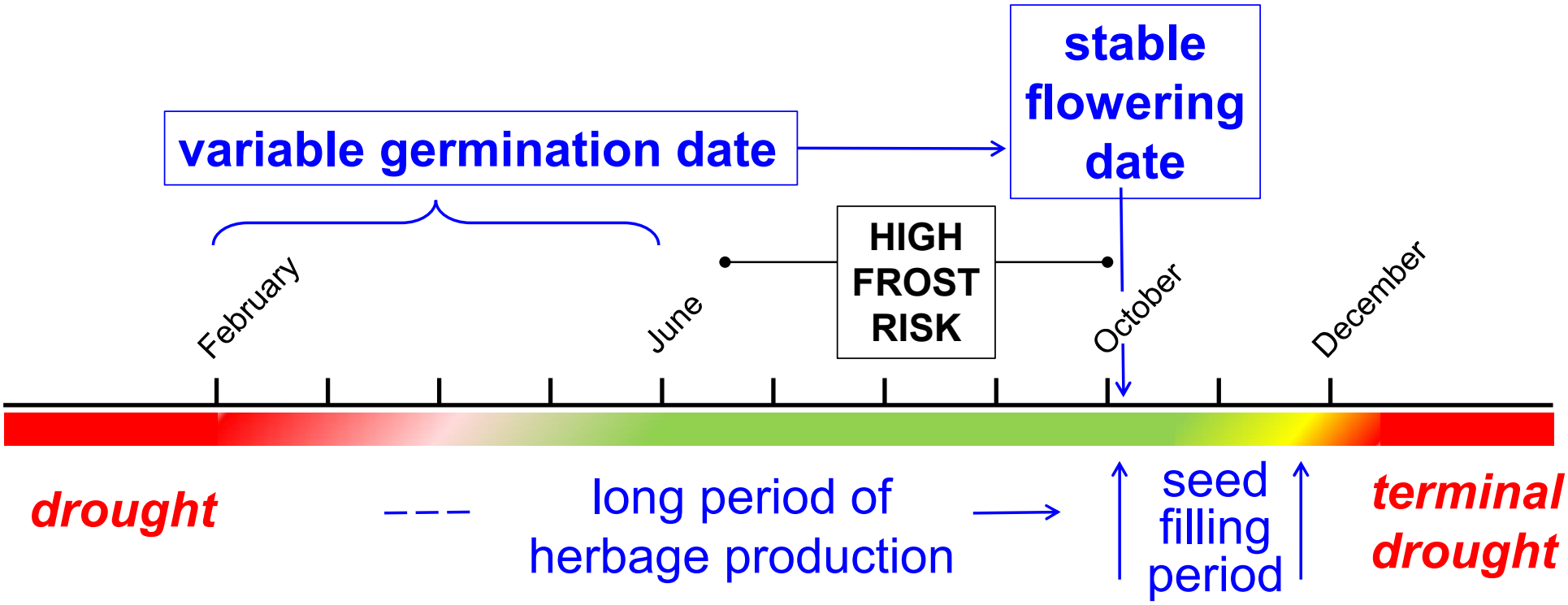
Advantages of serradella:

- lower phosphorus inputs
- low bloat risk
- few disease/insect issues
- comparable productivity value
- deeper roots → drought resilience
- good acid soil tolerance

Yellow serradella
(*Ornithopus compressus*)

French serradella
(*Ornithopus sativus*)

Annual legume production & persistence



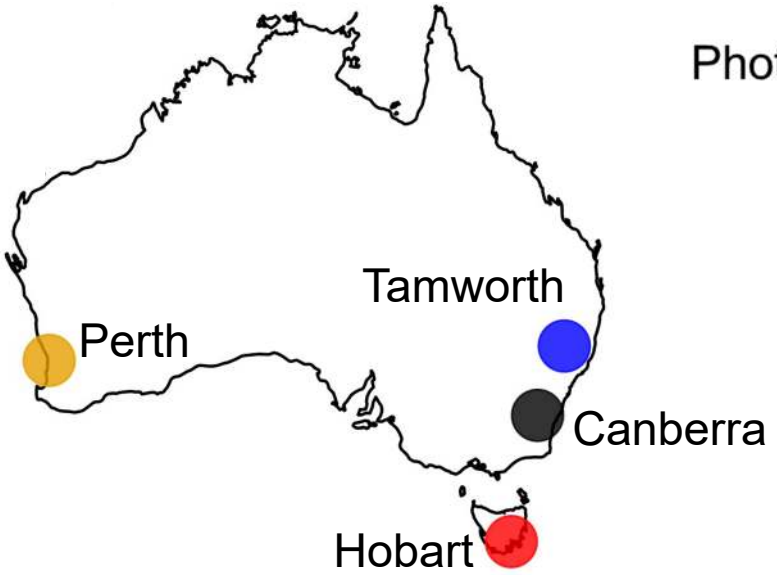
Adapted legumes flower at a similar date each year regardless of germination date

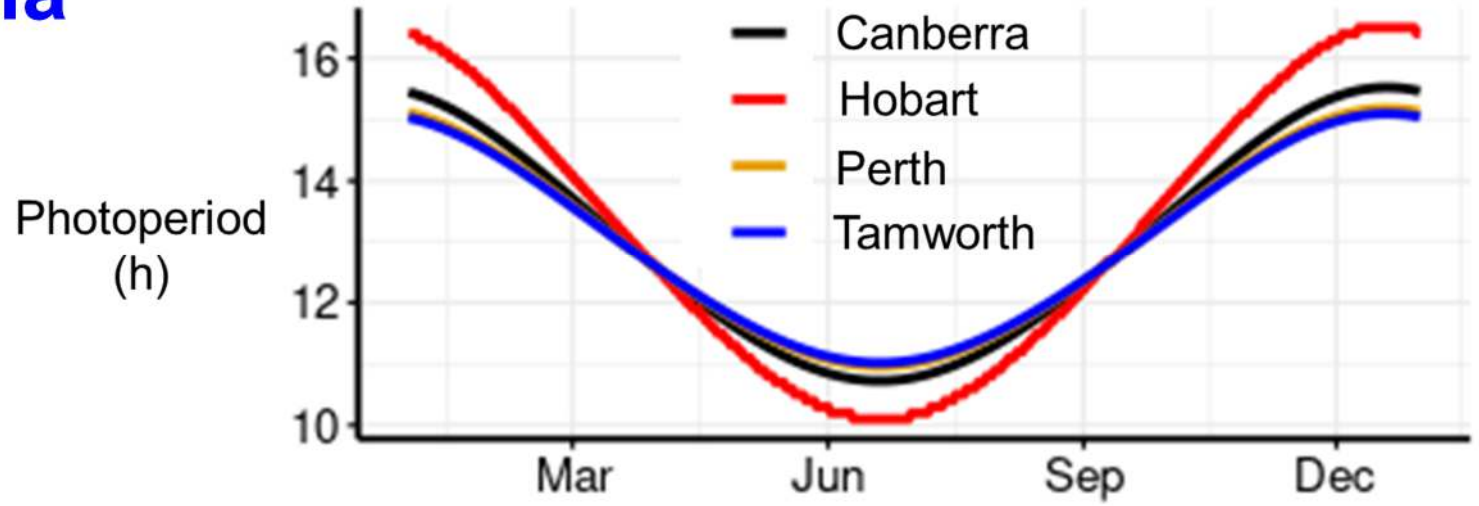
Stable flowering dates: **subterranean clover** ☑

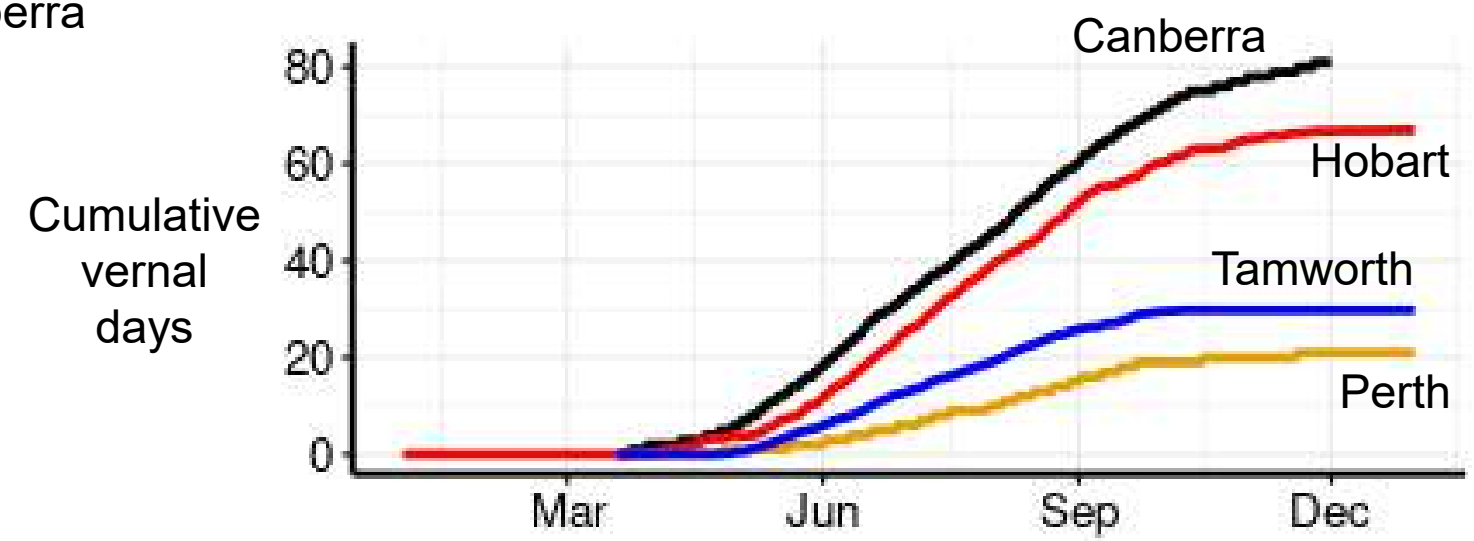
(Boschma *et al.* 2019)

serradellas ☒

Photoperiod and vernalisation conditions in southern Australia

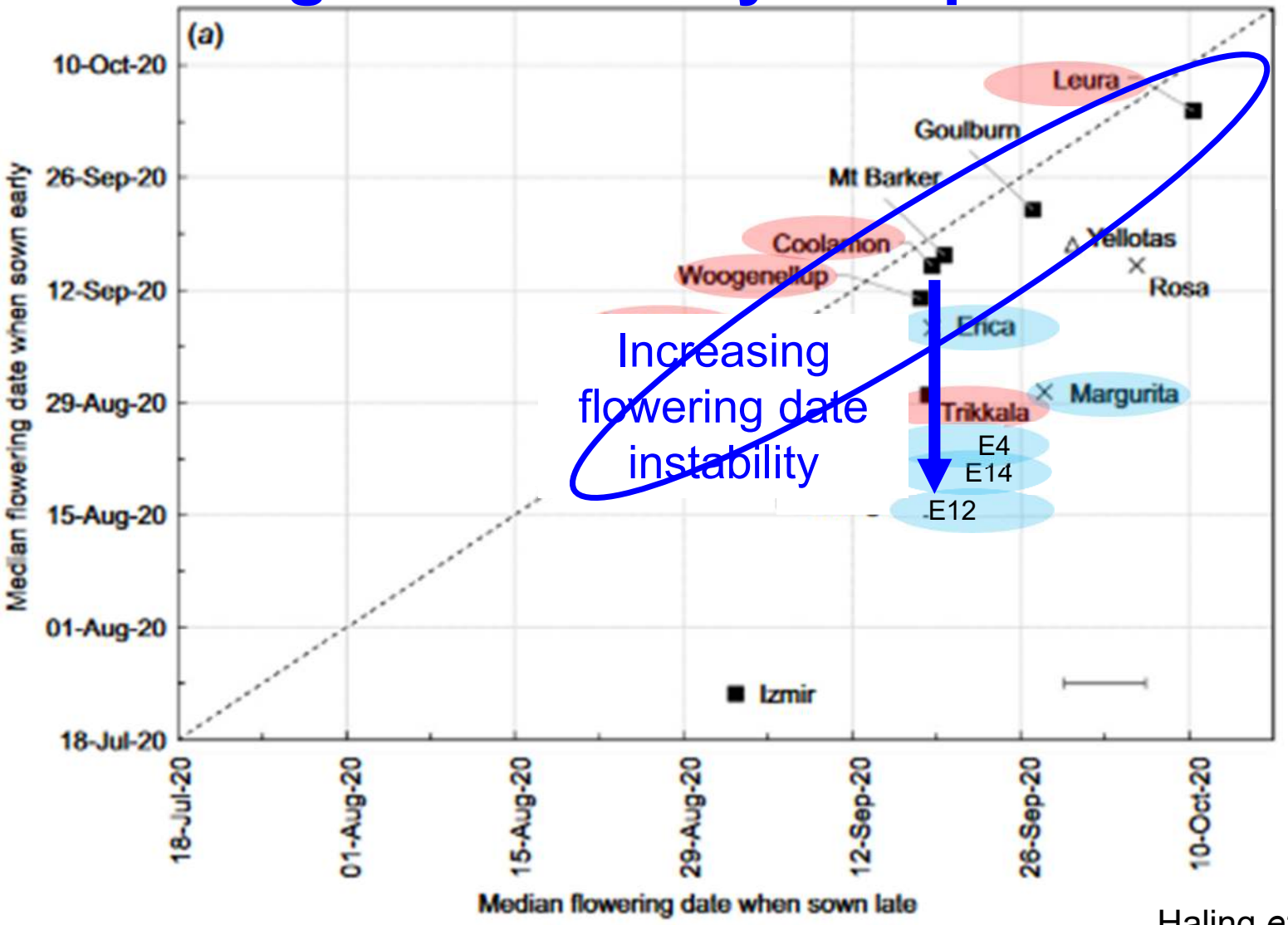






Goward 2024

Flowering date stability: temperate environment



Stable flowering dates

Subterranean clover

French serradella

Haling *et al.* 2022 *Crop & Pasture Science*

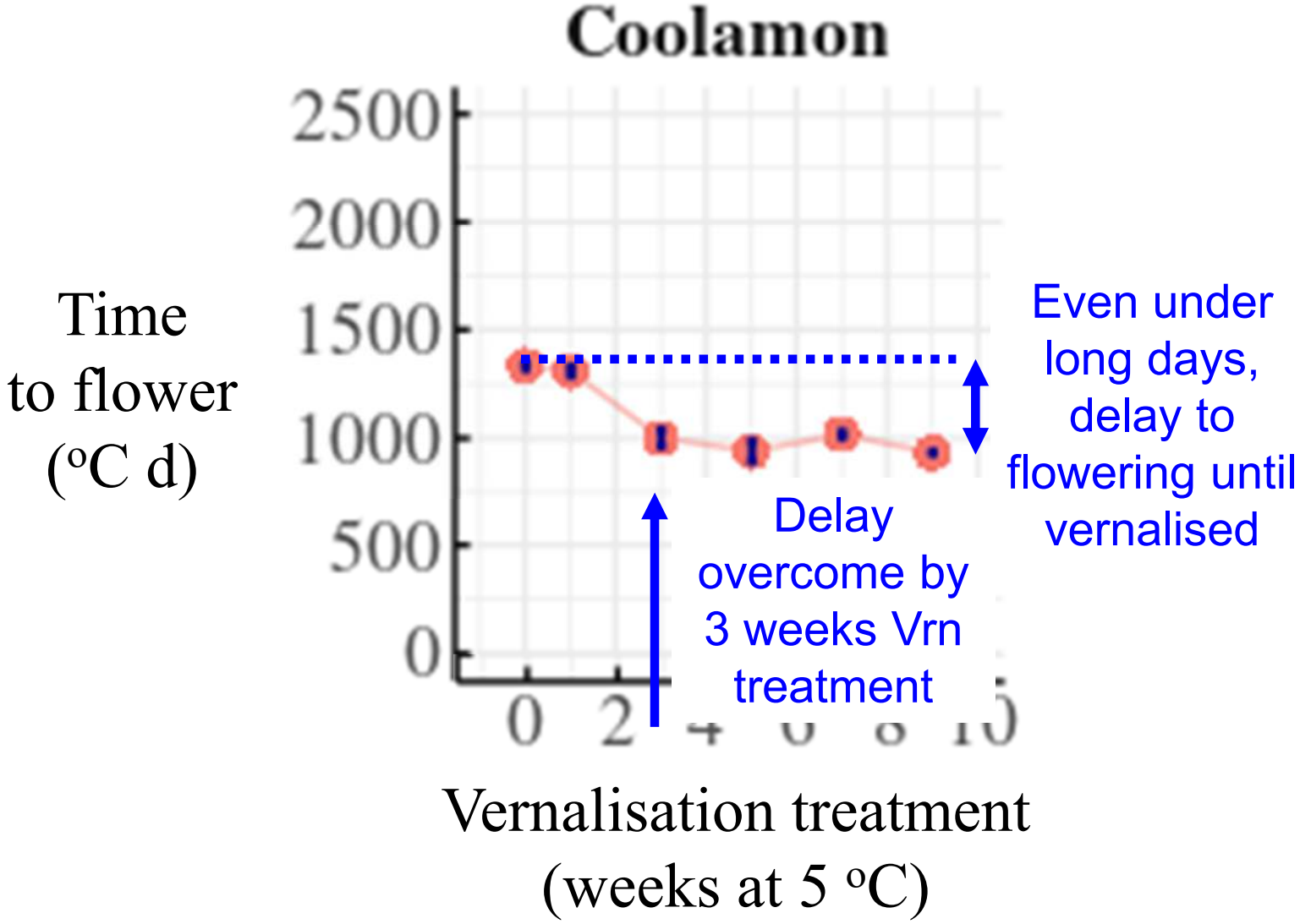
Experimental design

2 species
- Subterranean clover (cv. Seaton Park, cv. Trikalla,
- Woogenellup, cv. Coolamon, cv. Leura)
- French serradella (Margurita selections ‘E4’, ‘E12’ & ‘E14’, cv. Erica)

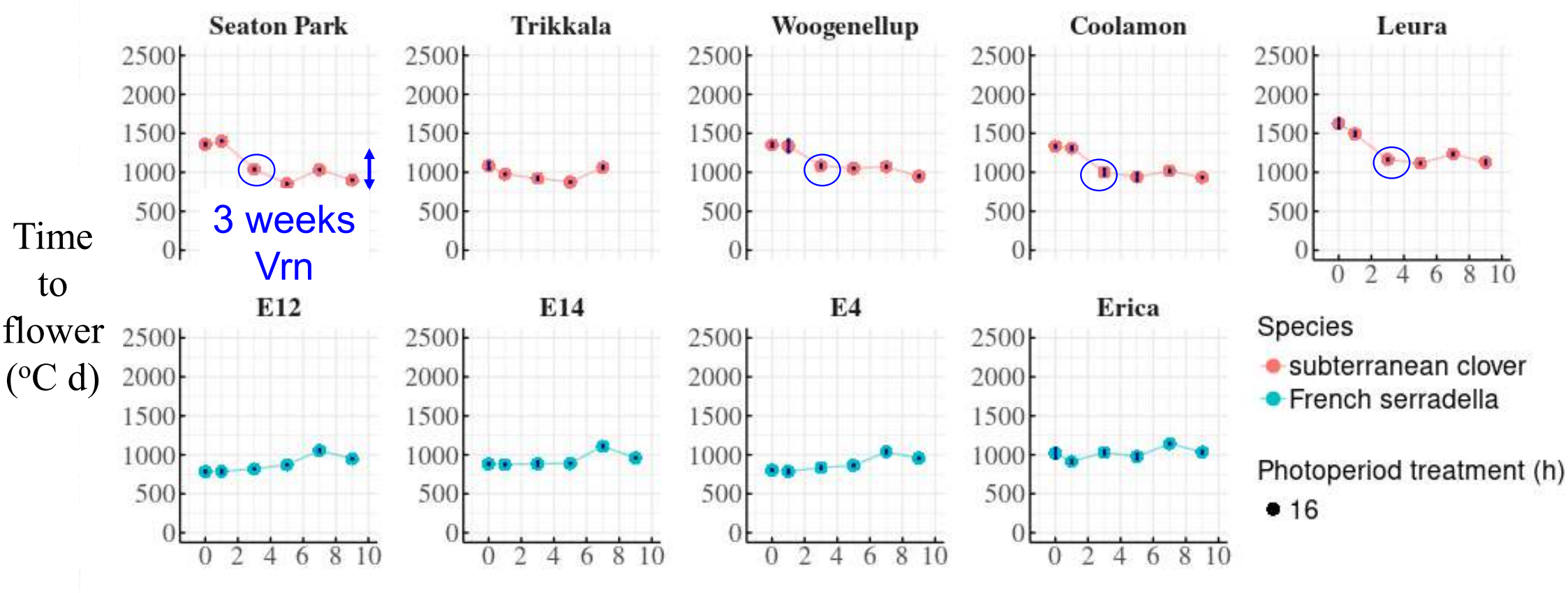
- 6 vernalisation treatments (0, 1, 3, 5, 7 & 9 weeks at 5°C)
- 2 photoperiod treatments (8 & 16 h daylengths)
- 5 reps

Establishment	**Vernalisation treatment** (weeks at 5°C)	**Photoperiod treatment**
All plants at 17/21°C for 14 days	9 7 5 3 1 0	Plants enter 1 of 2 trts (8 or 16 h) at 17/21°C on the same day

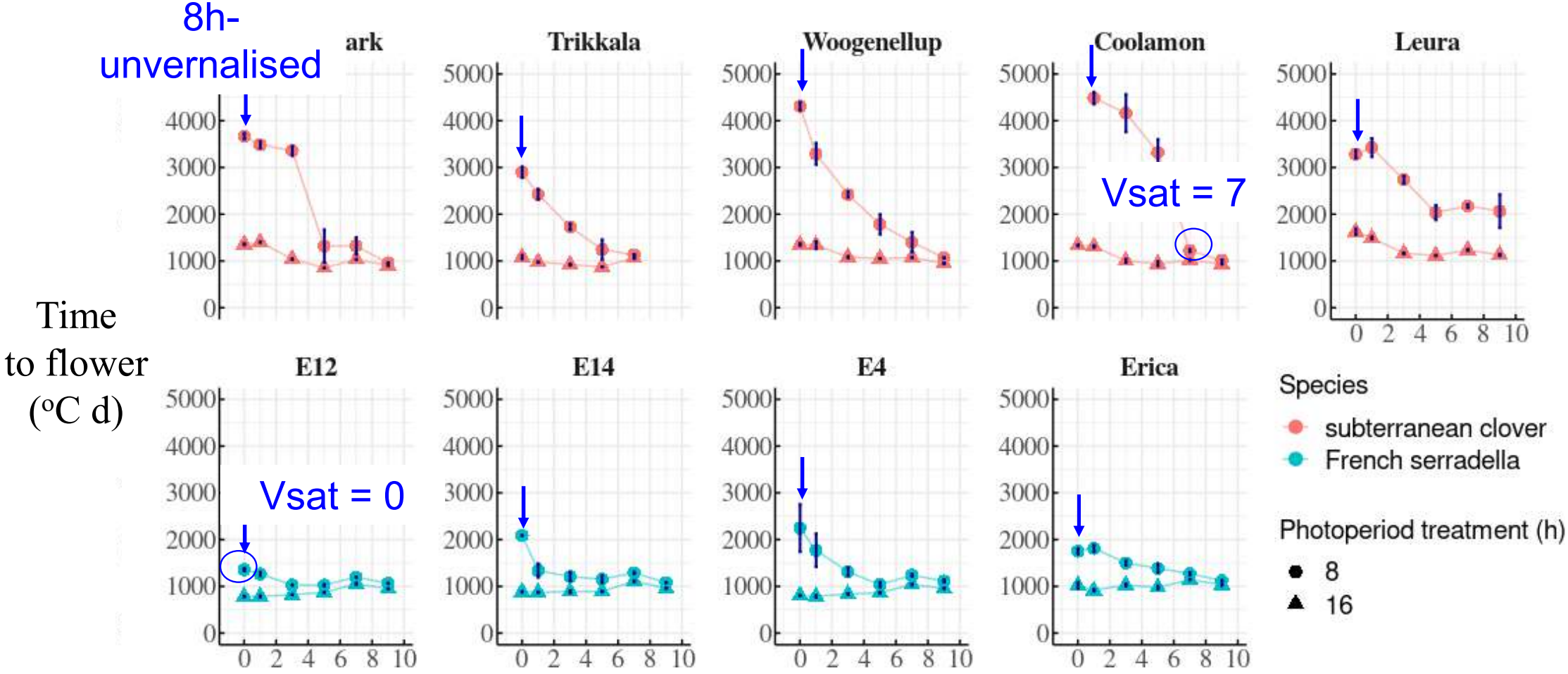
Results – response to vernalising temperature in 16 h



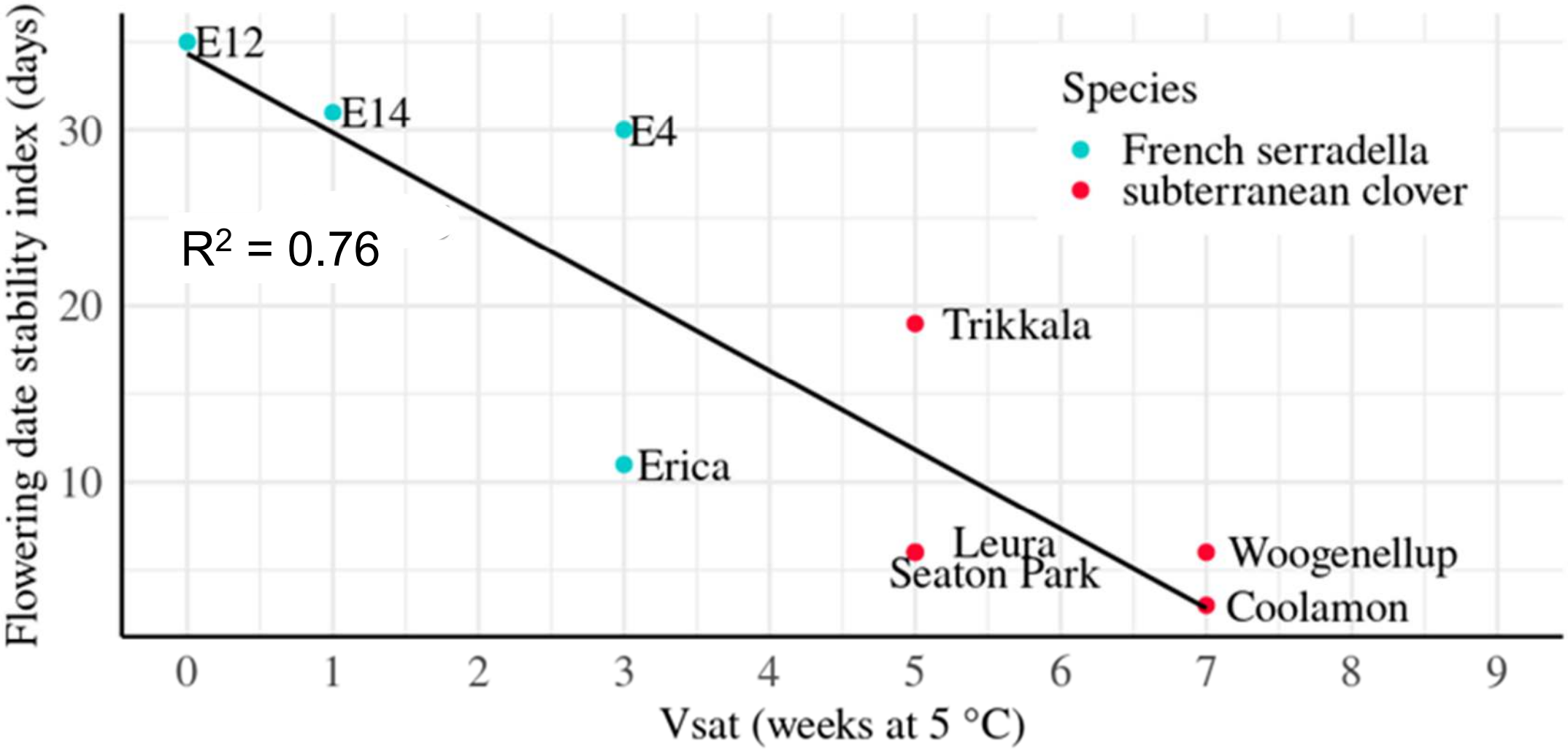
Genotypes with stable flowering dates expressed a delay to flowering until vernalised under long days



Genotypes differentiated by unvernalised–8 h response



Flowering date instability was correlated with lower thresholds for vernalisation saturation (Vsat) in 8 h Ppd



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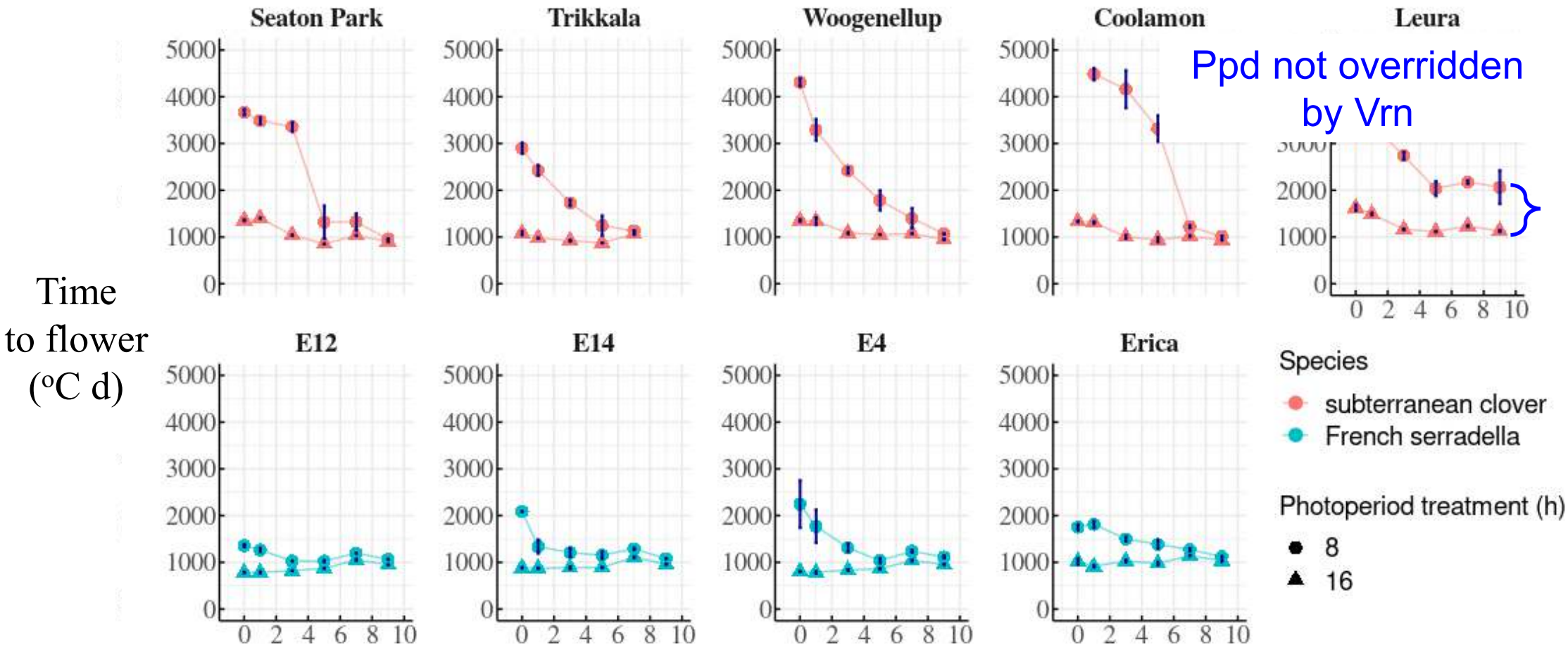

Conclusions

Stable flowering dates are achieved by:

- A photoperiod-insensitive vernalisation component of the flowering response protects against premature flowering when germination is ***very*** early.
- Vernalisation responses that prevent flowering before winter ends.
- Longer photoperiods and/or rapid thermal time step (in spring) then eliminate further need for vernalisation.