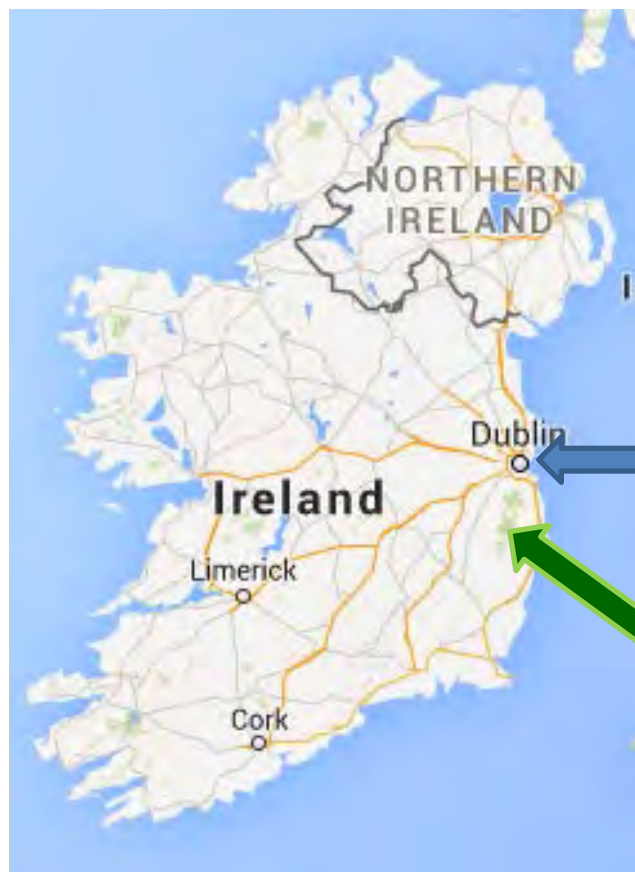


Contrasting ecophysiology & growth of genetically diverse Sitka spruce seedlings grown under limited *vs.* optimal water availability

Olga M. Grant, David Thompson, Conor O'Reilly

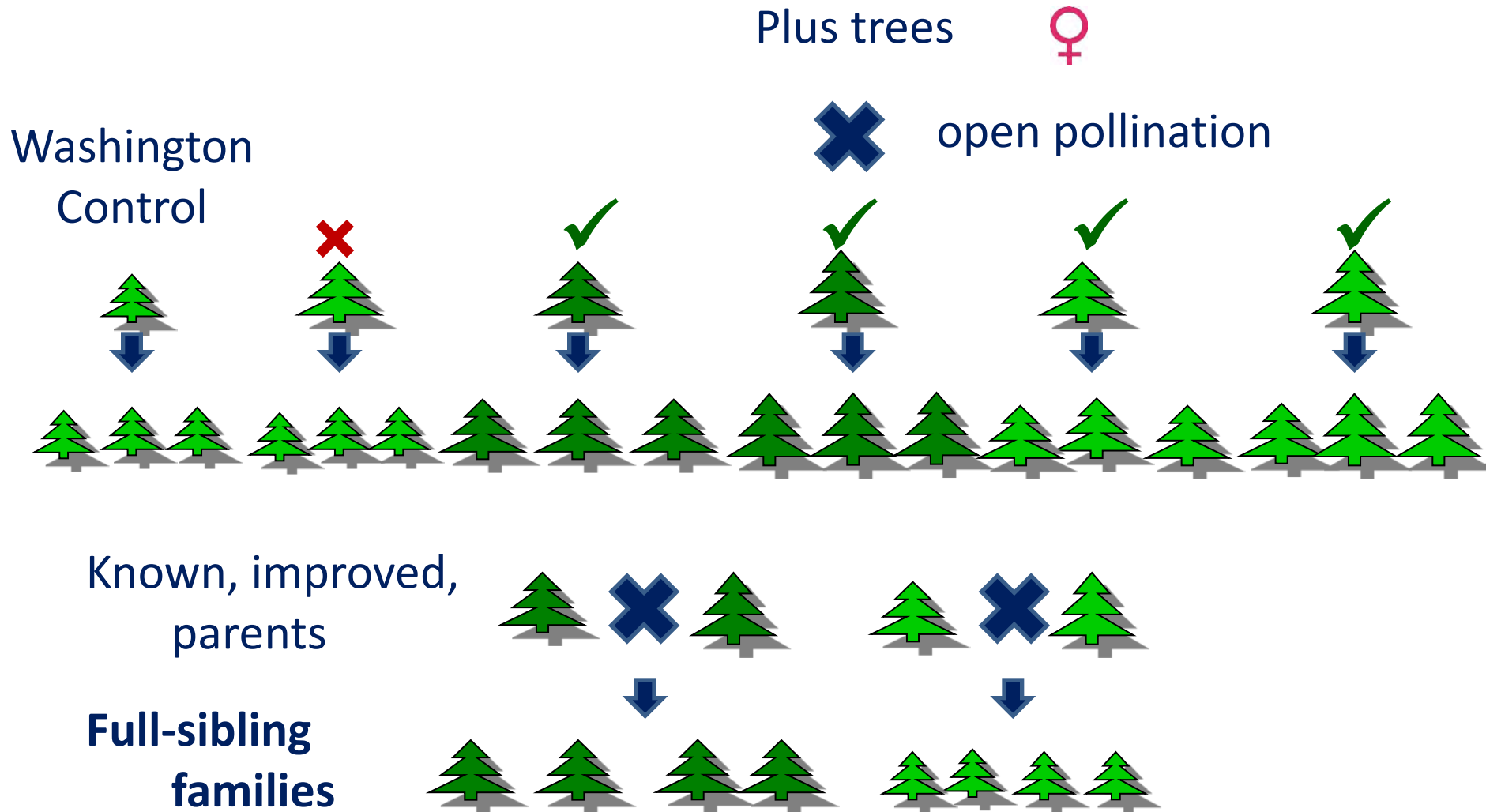
UCD Forestry & Coillte Tree Improvement



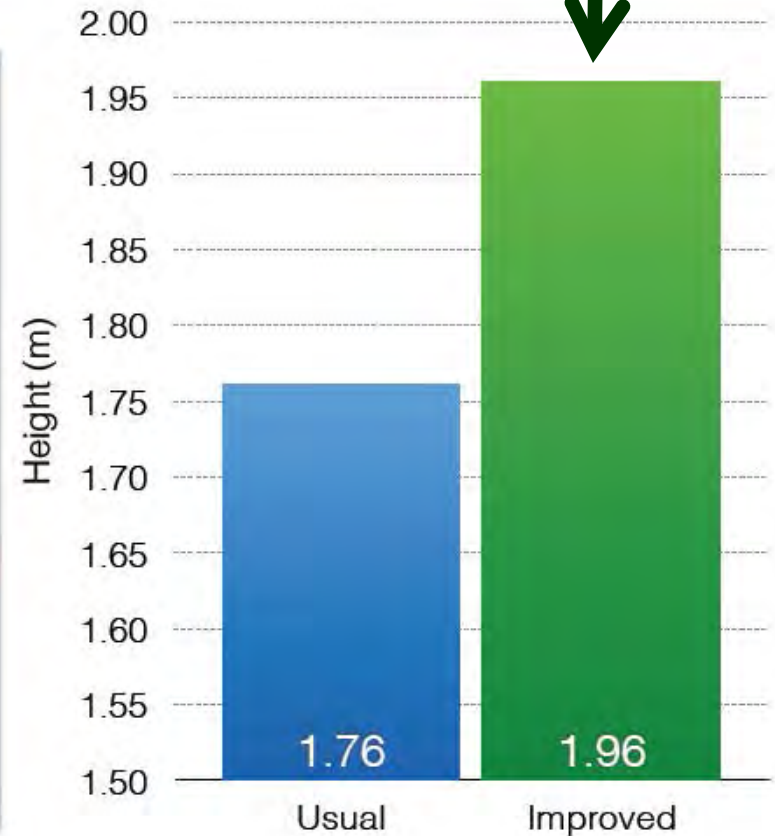
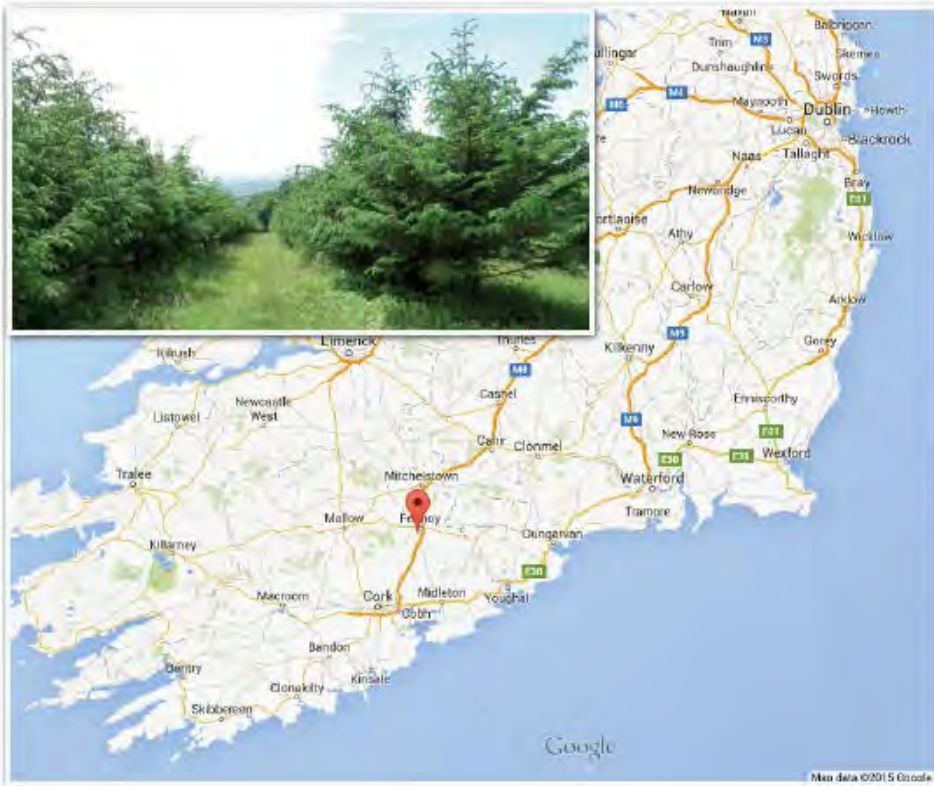


coillte

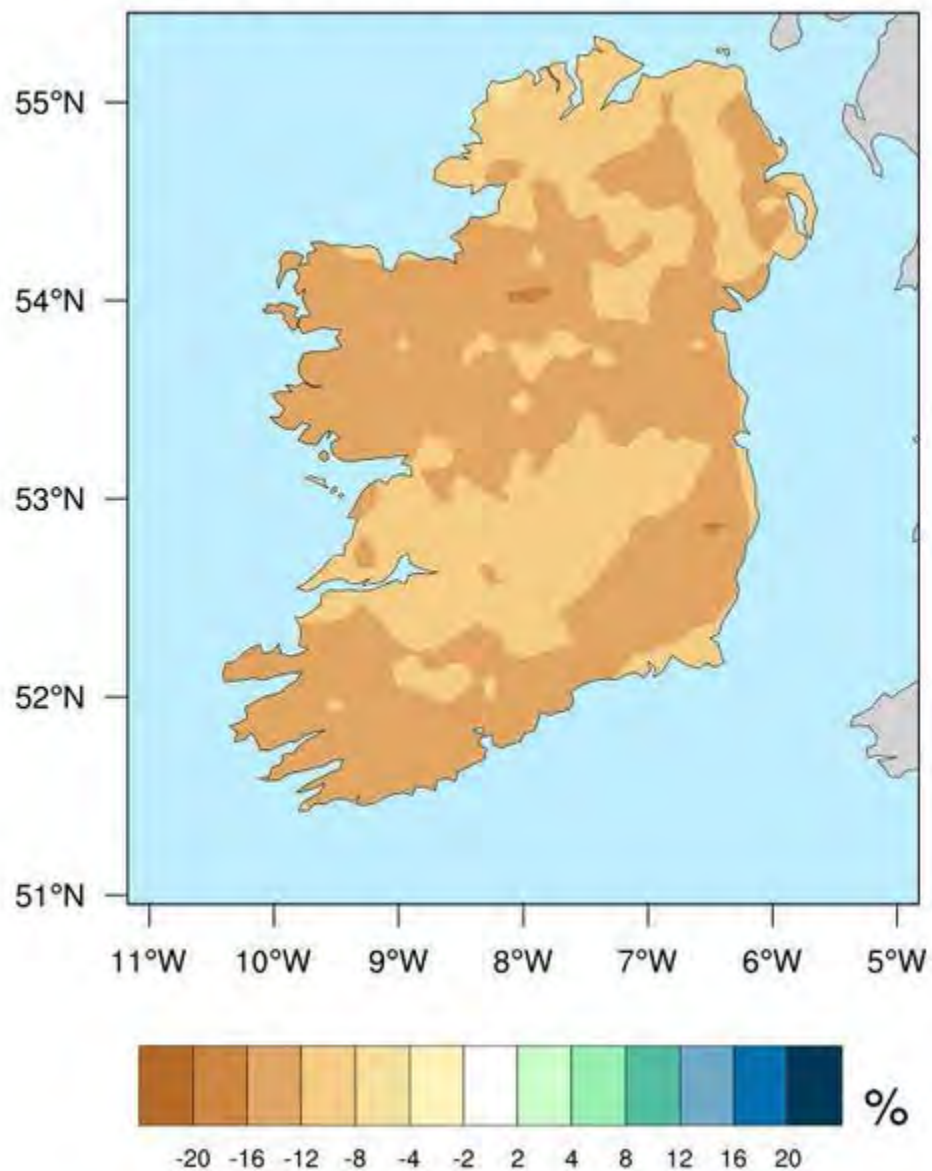
Sitka spruce improvement



Sitka spruce improvement



High Emission: Summer Rainfall change



2050

2-factor experiment

‘Family’

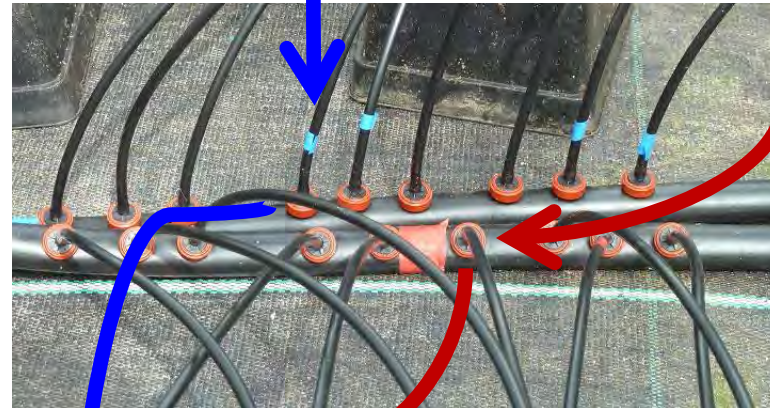
= 9 improved full-sibling families + Washington control

×

‘Water availability’

- Water-limited vs. control (optimal)

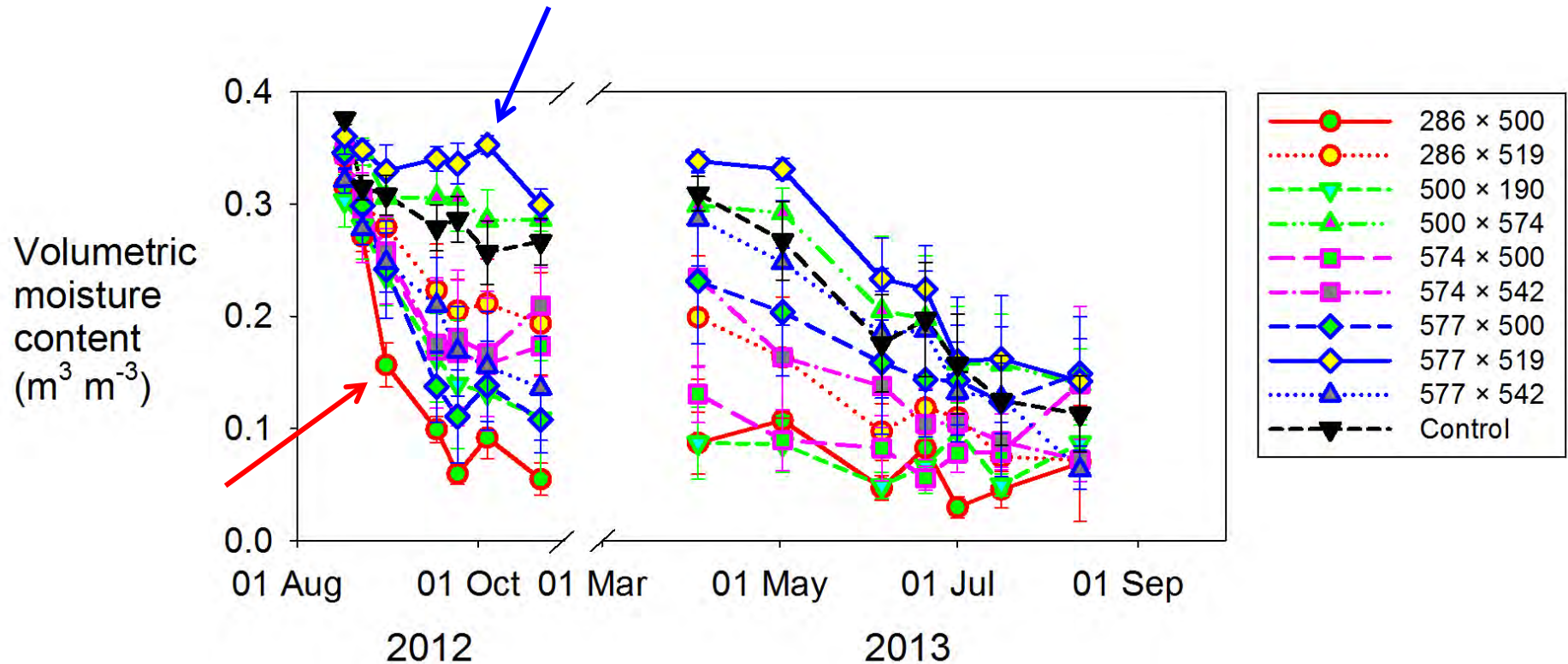
Greenhouse experiment



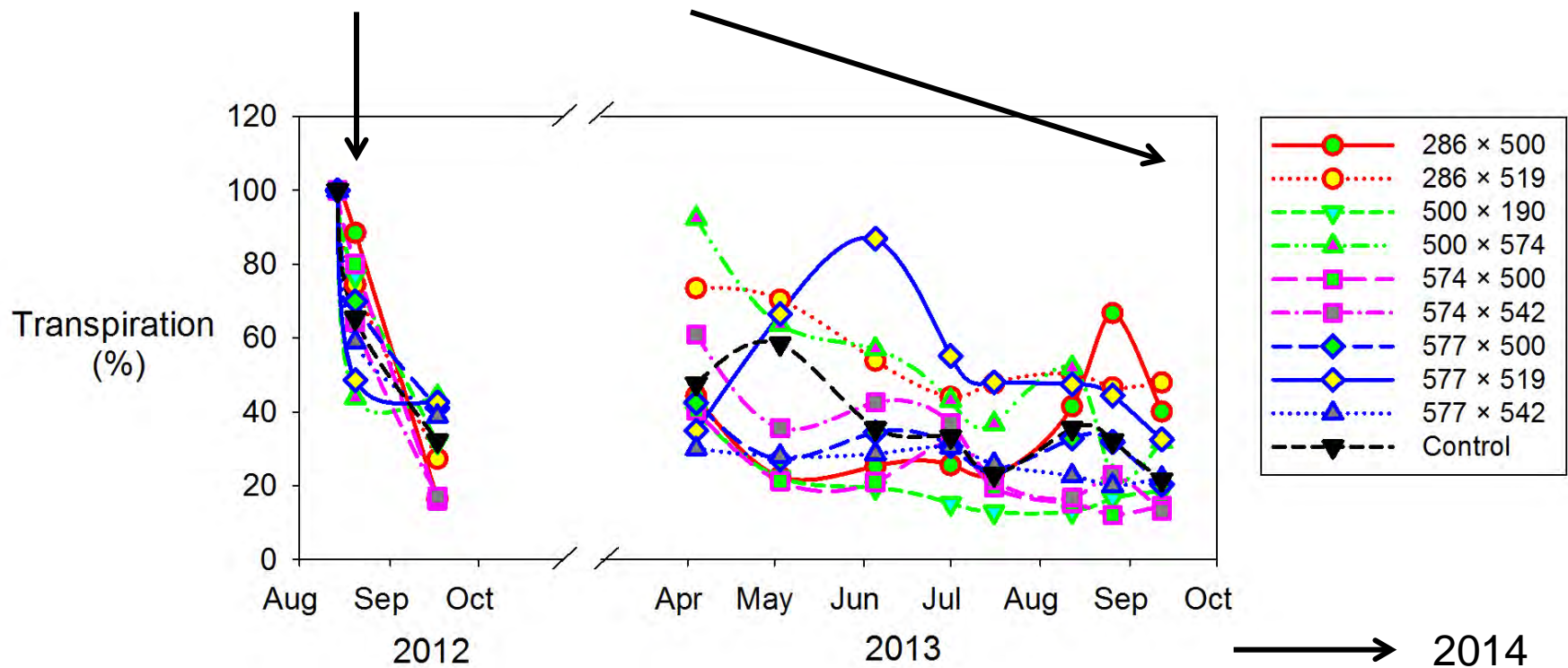
Irrigation scheduling



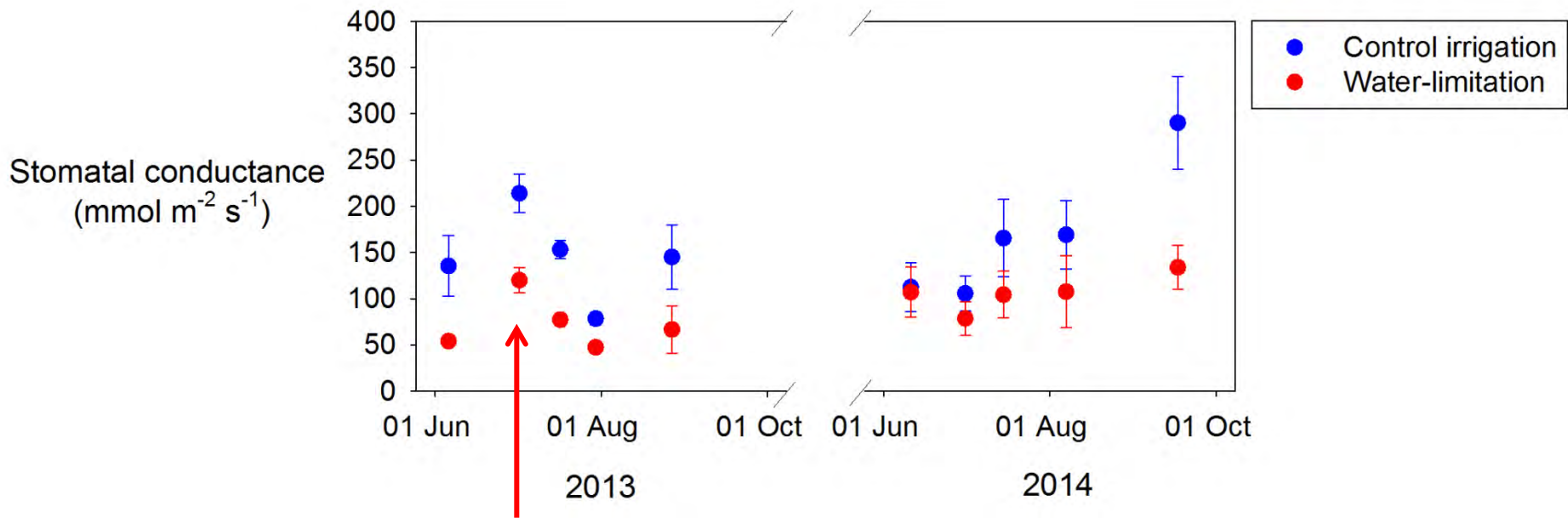
Impact of water deficit



Impact of water-limitation on ecophysiology



Impact of water-limitation on ecophysiology

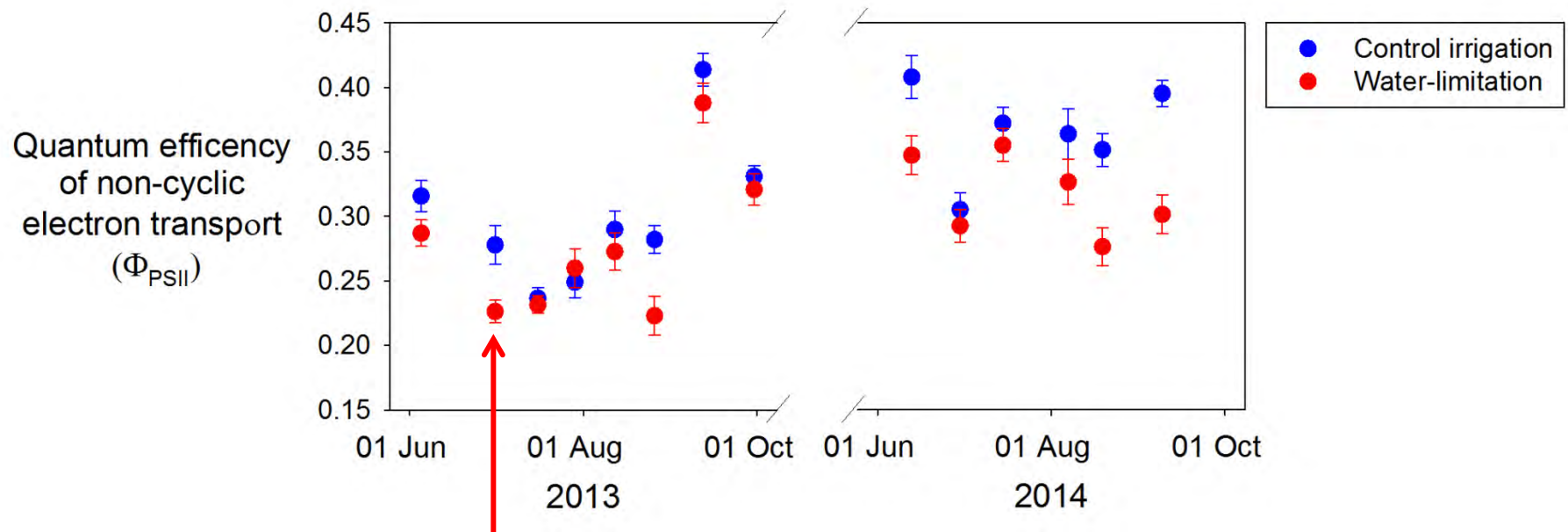


Reduced stomatal conductance

Reduced branch water potential:
–1.4 MPa by July 2014

Very mild photoinhibition
(F_V/F_M of 0.77) detected
only once

Impact of water-limitation on ecophysiology

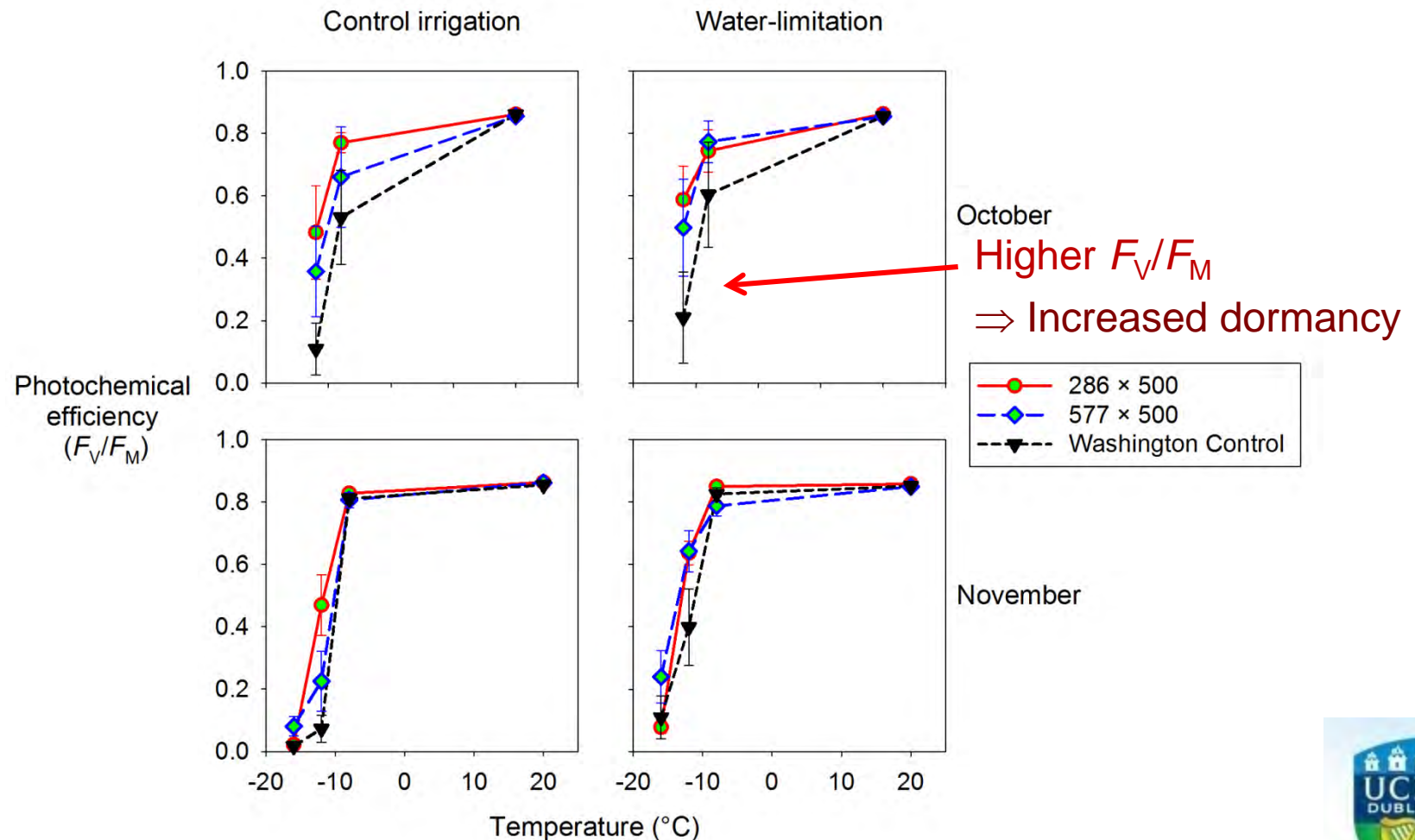


Reduced Φ_{PSII}

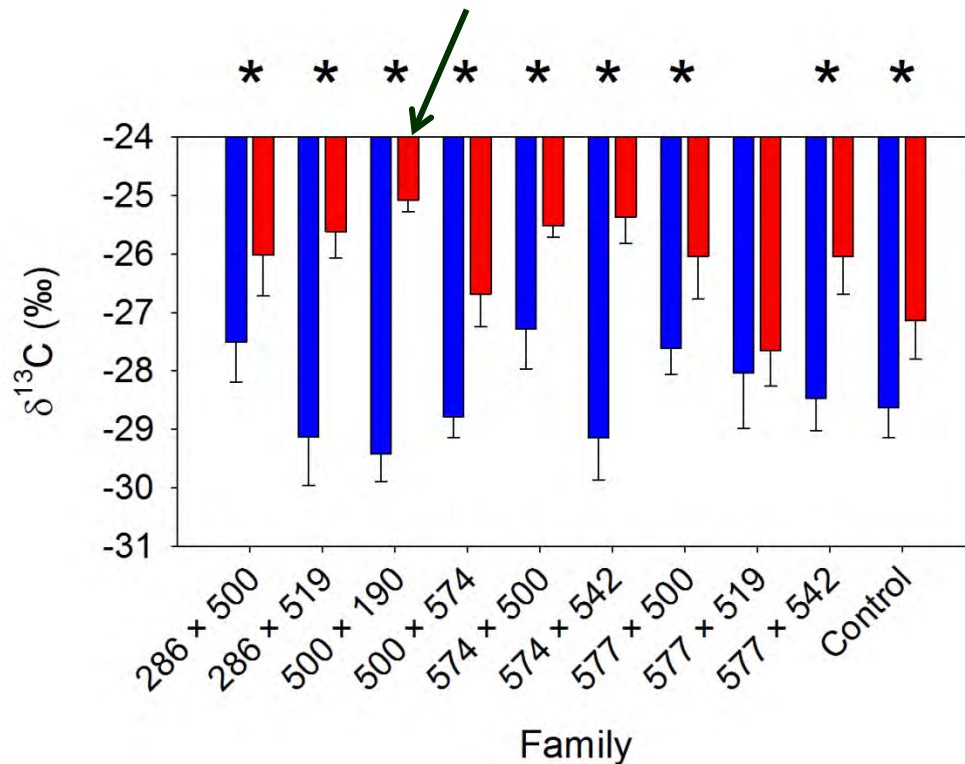
⇒ Reduced Electron Transport Rate

⇒ Reduced photosynthetic assimilation

Impact of water-limitation on ecophysiology



Impact of water-limitation on ecophysiology



2013

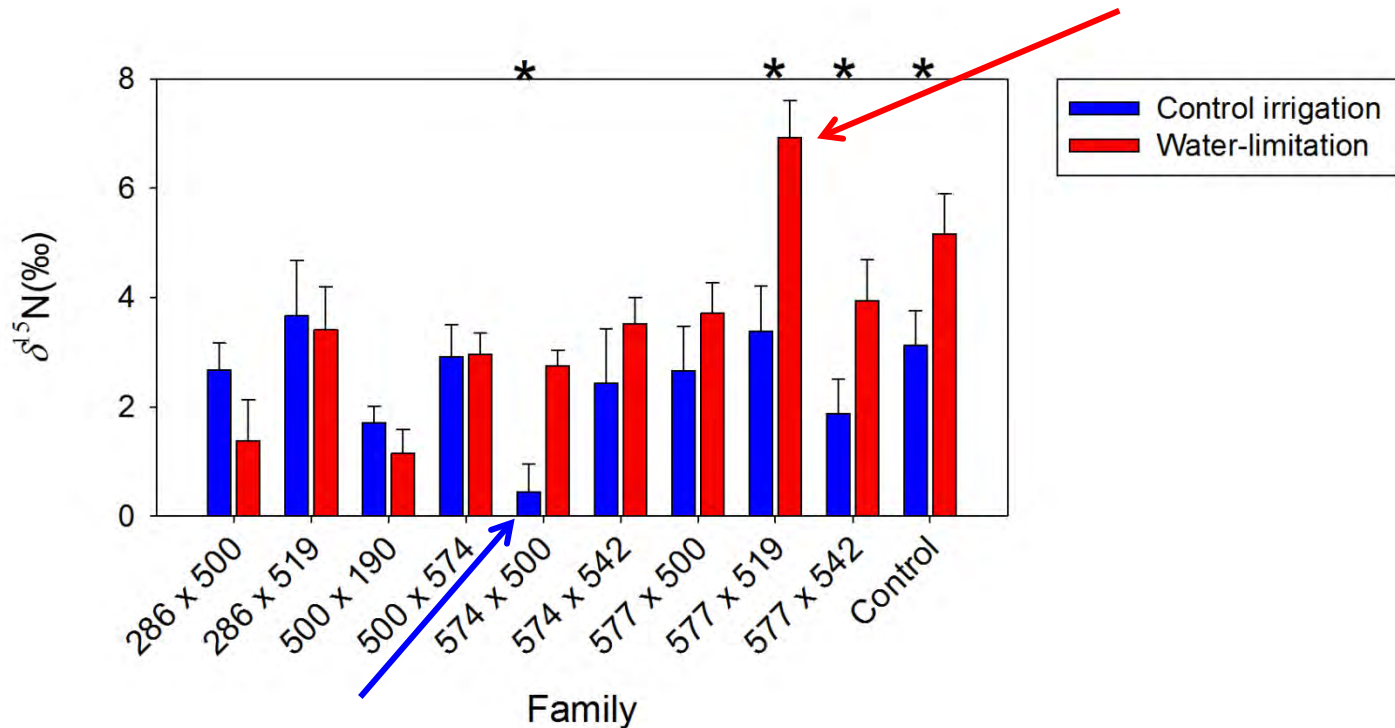
Improved water use efficiency
in needles of all but least
vigorous seedlings

**Whole plant water use
efficiency increased in ALL
families**

2014

Improved water use efficiency
in needles of ALL water-limited seedlings

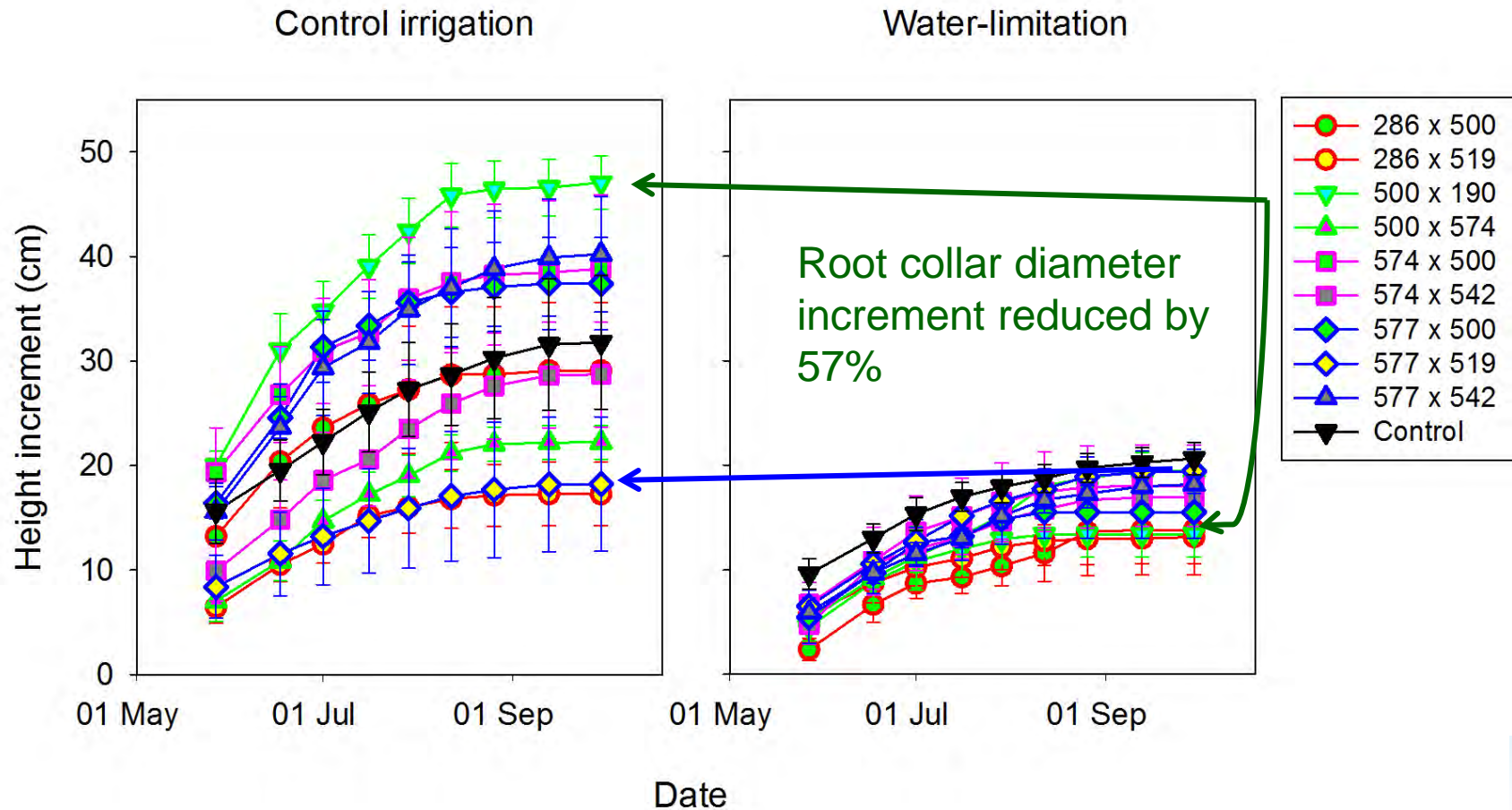
Impact of water-limitation on ecophysiology



2014 Increased $\delta^{15}\text{N}$
in needles of ALL water-limited seedlings

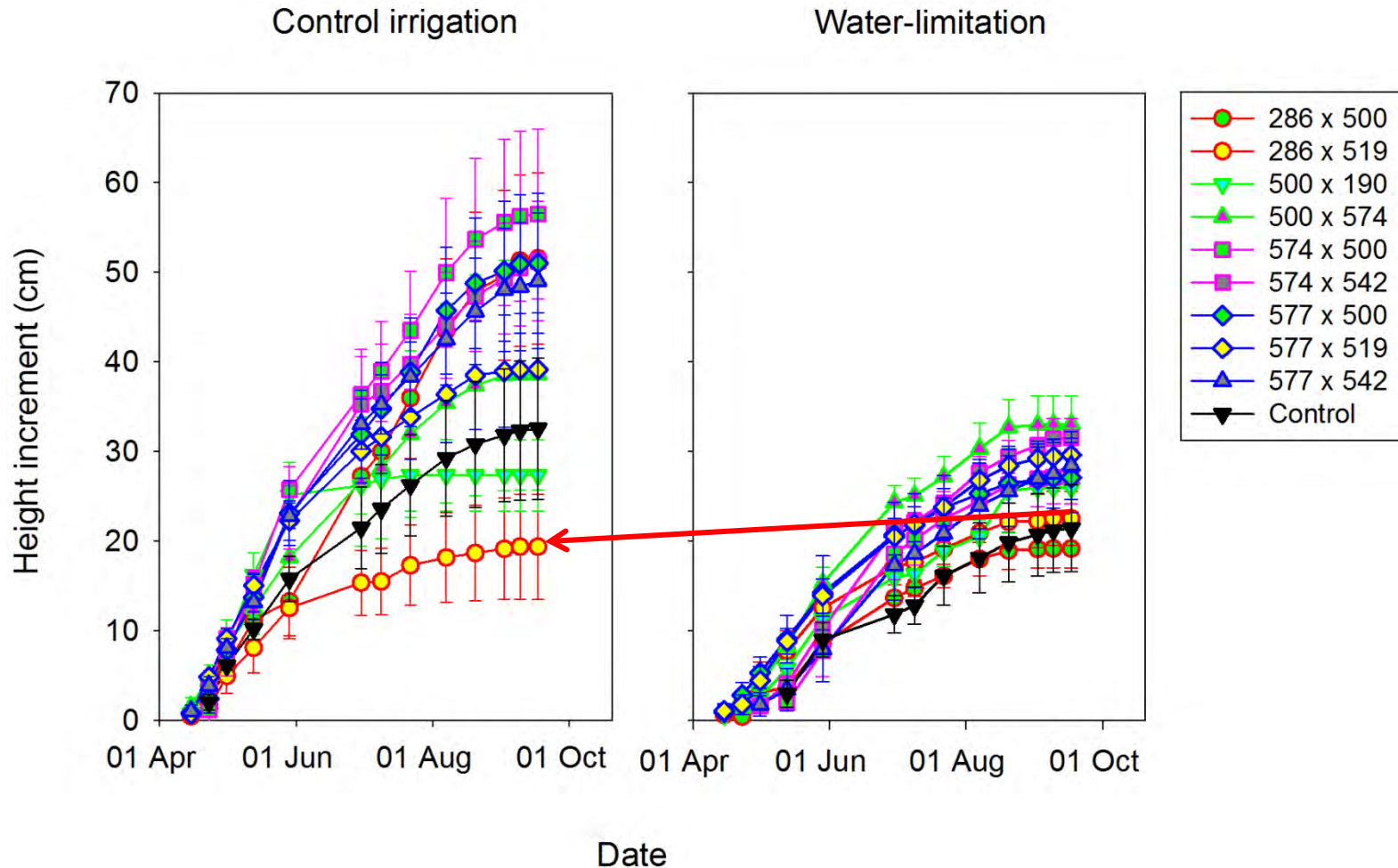
Impact of water-limitation on growth

2013



Impact of water-limitation on growth

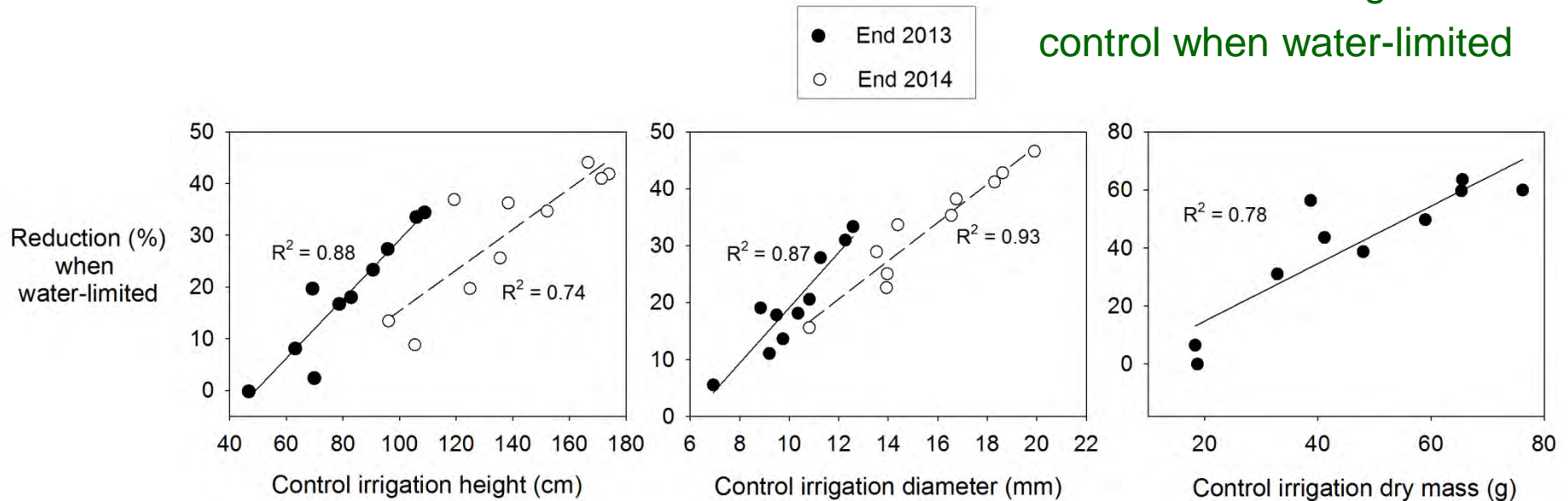
2014



Impact of water-limitation on growth

End 2014:

8 out of 9 improved families
taller than Washington
control when water-limited



Impact of water-limitation on biomass



Year 3 growth:



Reduced specific leaf area

Conclusions

- Considerable variation in vigour within selection of full-sibling families from Coillte's improvement programme
- Greater impact of water-limitation on more vigorous seedlings
- But benefit of genetic improvement even when water is limiting

Acknowledgements



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