



Grape leaves may be more vulnerable to heat waves in cool than in warm seasons

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Introduction

- Climate change is increasing the frequency and magnitude of extreme weather events
- Grapevines acclimate to stable weather
- A sudden temperature change can compromise vine productivity
- A heat wave is a sudden temperature increase lasting for few days
- A cooling system to mitigate heat waves might help to stabilize grape production

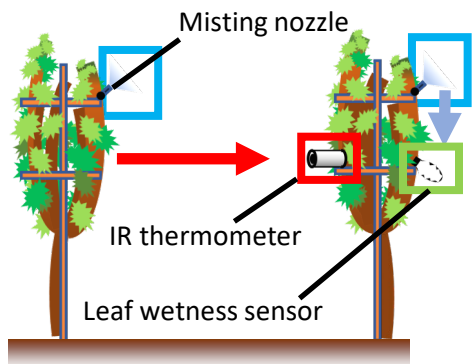


Fig. 1. Mist-type evaporative cooling system (MECS). Misting nozzles spray fine water droplets to cool the leaves. Infrared thermometer measures canopy temperature and activates the system if temperature is above critical threshold. Leaf wetness sensor stops the system as leaf surfaces are saturated with water.

- **Knowing how acclimated vines respond to temperature changes is essential for determining the critical temperature to activate cooling**

Materials and Methods

- Well-irrigated Cabernet Sauvignon in growth chambers
- Acclimation conditions
 - Duration: 10 days
 - Warm season: 15°C/32°C
 - Cool season: 10°C/27°C
- Day 11 temperature regimes (°C)
 - 23/40, 20/37, 18/35, 15/32, 13/30, 8/25
- Measurements:
 - Gas exchange:
 - Photosynthesis rate (Pn)
 - At noon (high light intensity)
 - At late afternoon (maximum air temperature)
 - Relative changes were calculated:
 - Day 11 / Day 10 (%)

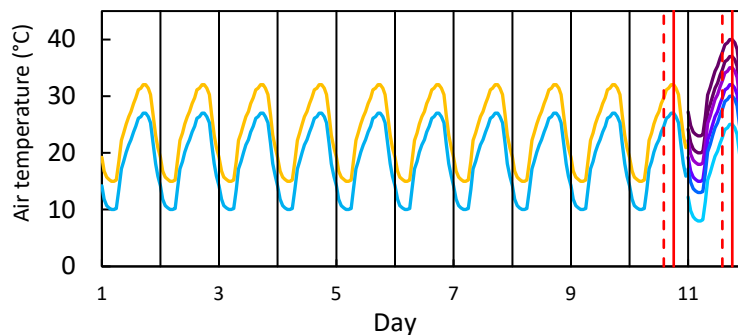


Fig. 2. Acclimation and temperature change plan in growth chambers. Vines were acclimated in simulated warm and cool seasons for 10 days. On day 11, vines were exposed to six levels of temperature change regimes. Gas exchange was measured at noon (red dash line) and late afternoon (red solid line) on days 10 and 11.

Results

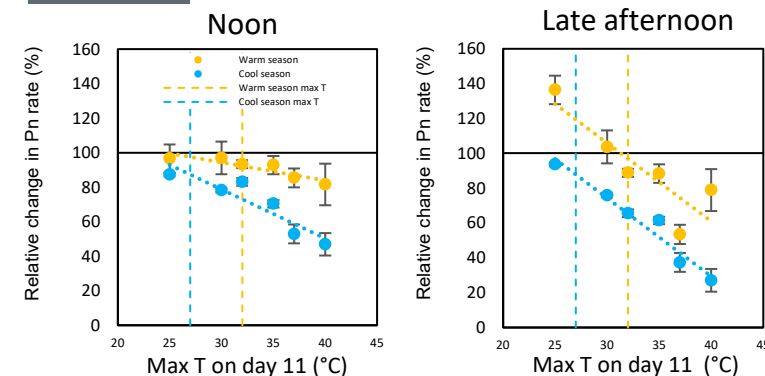


Fig. 3. Relative change in photosynthesis (Pn) rate at noon and late afternoon. The vertical dash lines depict the maximum temperature during the acclimation period for warm and cool seasons. Each point represents the relative change in Pn between day 10 and day 11 (n = 4). The x-axis represents the maximum temperature on day 11 for each regime.

- The Pn rate was depressed due to sudden increases in air temperature
- The degree of depression in Pn rate increased with the magnitude of temperature change
- Vines in the simulated cool season were more sensitive to sudden temperature changes

Conclusion

Vines might be more vulnerable to sudden temperature changes in a cool season or climate than in a warm season or climate. The results suggest a dynamic activation threshold temperature is required for the canopy cooling system to optimize vine production. A fixed activation threshold might not be sufficient for maximum photosynthesis in different scenarios.

Acknowledgements

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