

Silicon improves tomato plants' performance under single and combined nitrogen and water deficits

Joana Machado^{1,2,3}, Ana P.G. Fernandes^{1,2}, Ep Heuvelink³, Susana M.P. Carvalho², Marta W. Vasconcelos^{1*}

¹Universidade Católica Portuguesa, CBQF – Centro de Biotecnologia e Química Fina ; ²GreenUPorto & DGAOT, Faculty of Sciences, University of Porto; ³Wageningen University. *corresponding author:mvasconcelos@ucp.pt

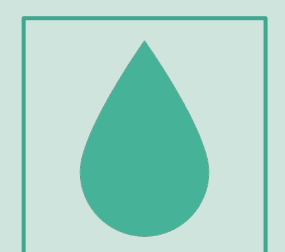
INTRODUCTION

Principal Challenges



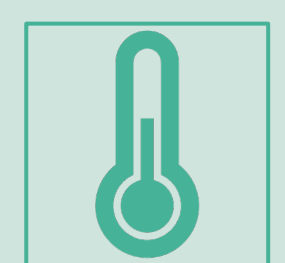
Increase in world population

- Expected to grow from 8 to ≈ 9.5 billion by 2050



Sustainable resource management

- Finite agricultural resources
• Agriculture uses about 80% of freshwater resources
• Excessive use of fertilizers



Climate Change

- Global warming
- More frequent floods and droughts

Sustainable Mitigation Strategies



ee → Silicon (Si) plays an important role in alleviating several abiotic stresses

ee → One of its key mechanisms involves the stimulation of the antioxidant system (AOX).

ee → Effective strategy for relieving drought stress

ee → Knowledge about its role in alleviating nutrient deficiencies is still limited.

KNOWLEDGE GAPS?

While several studies have focused on Si role in alleviating the effects of single stresses, the effects of Si on single N deficit or combined N and water deficit are yet poorly explored

MATERIAL AND METHODS



GROWTH CONDITIONS

- Temp.: 25°C (DT) /23°C (NT)
- Humidity: 70%
- Light Intensity: 300 μmol m⁻² s⁻¹
- Photoperiod: 16h
- Substrate: 100% Vermiculite
- Trial Duration: 27 days post-transplanting (dpt)

Solanum lycopersicum L.
cv. Micro-Tom

CONTROL (CTR)	N DEFICIT	W DEFICIT	N + W DEFICIT
AT TRANSPLANTING: Irrigated with nutrient solution until reaching 100% Field Capacity (FC)			
Complete nutrient solution	N deficient nutrient solution	Complete nutrient solution	N deficient nutrient solution
DURING GROWTH:			
Kept at 100% FC with distilled water	Kept at 100% FC with distilled water	No irrigation until 50% FC (10 dpt)	No irrigation until 50% FC (10 dpt)
		Kept at 50% FC with distilled water (10 to 27 dpt)	Kept at 50% FC with distilled water (10 to 27 dpt)

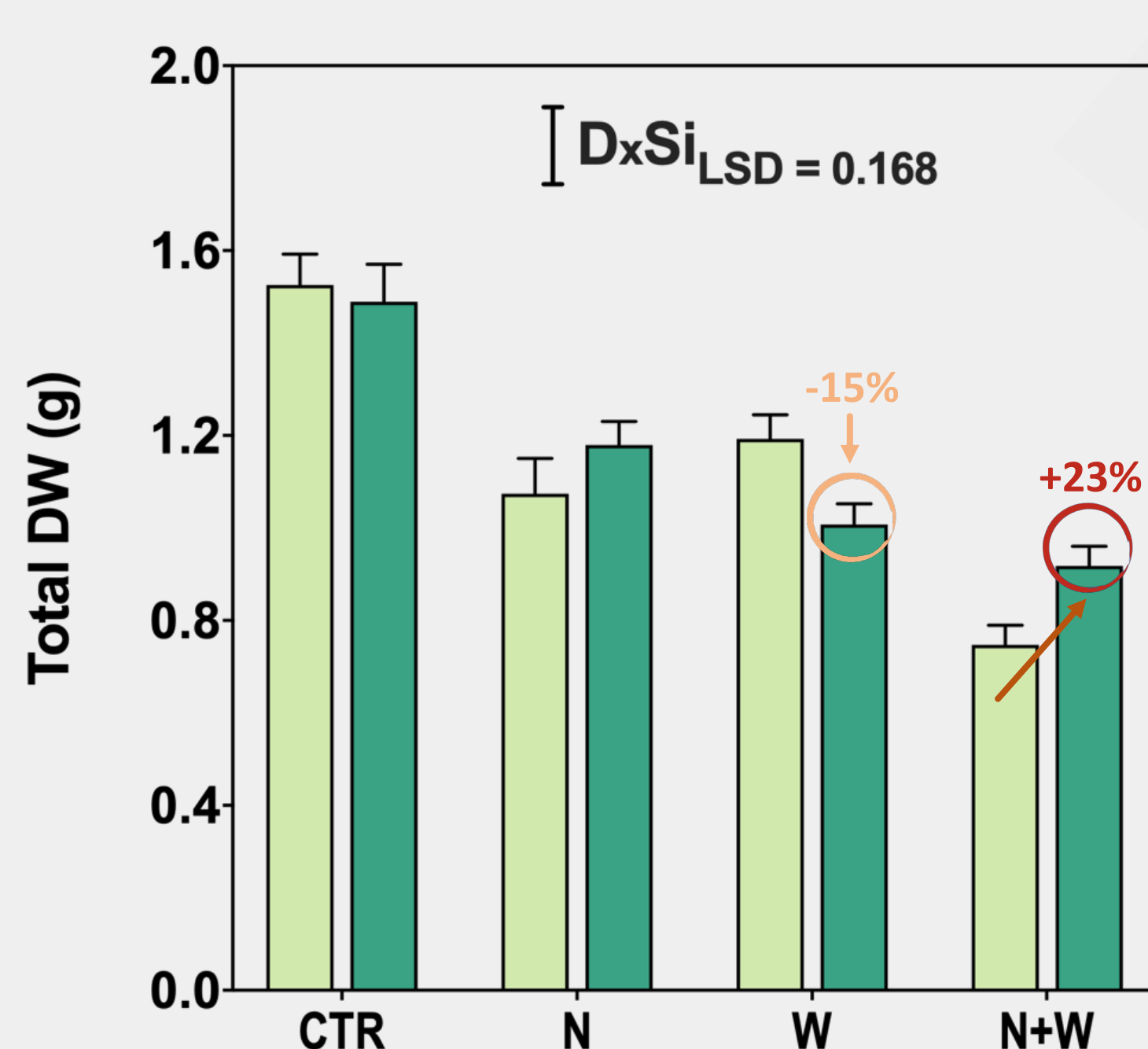


0 mM Na₂SiO₃

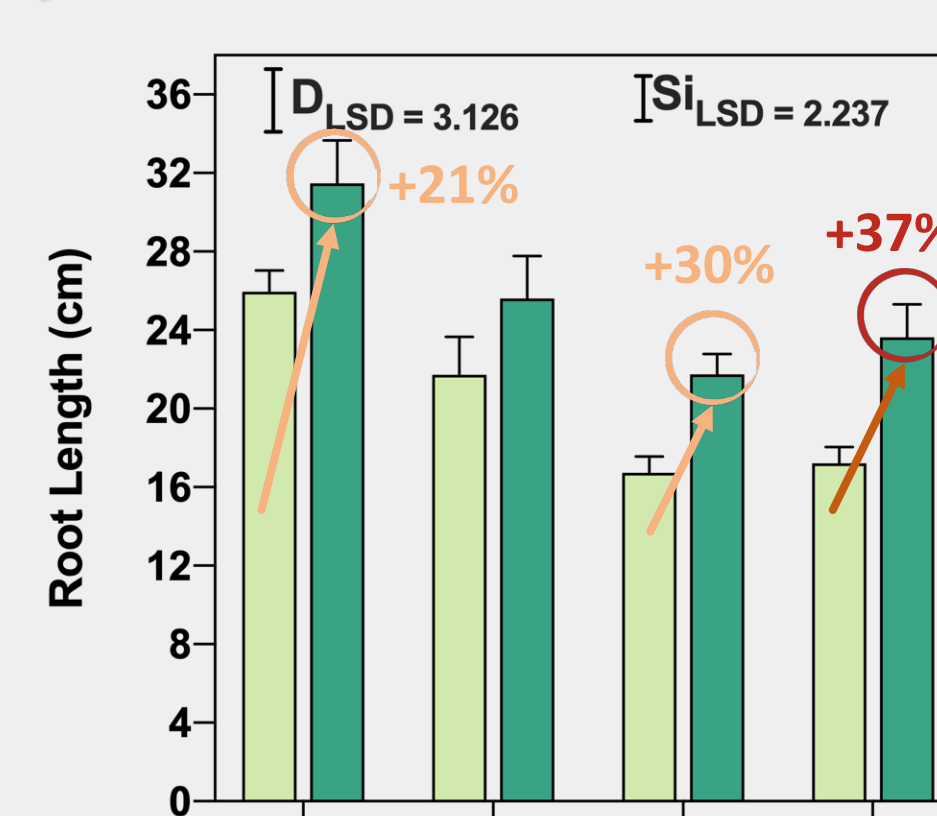
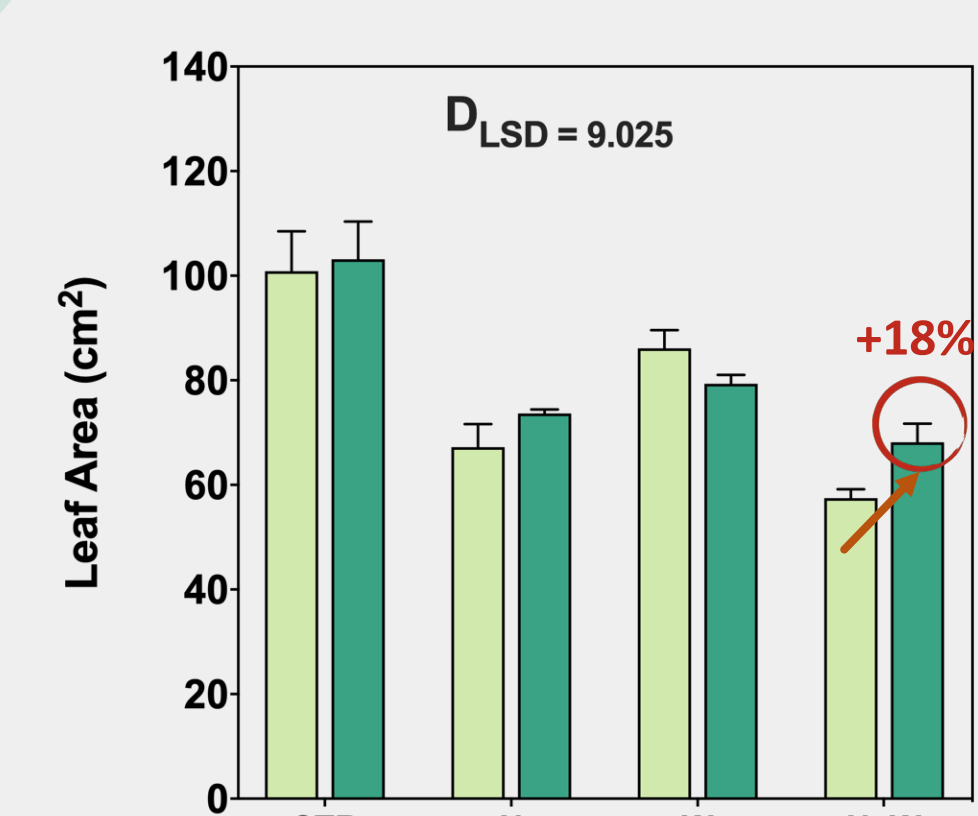
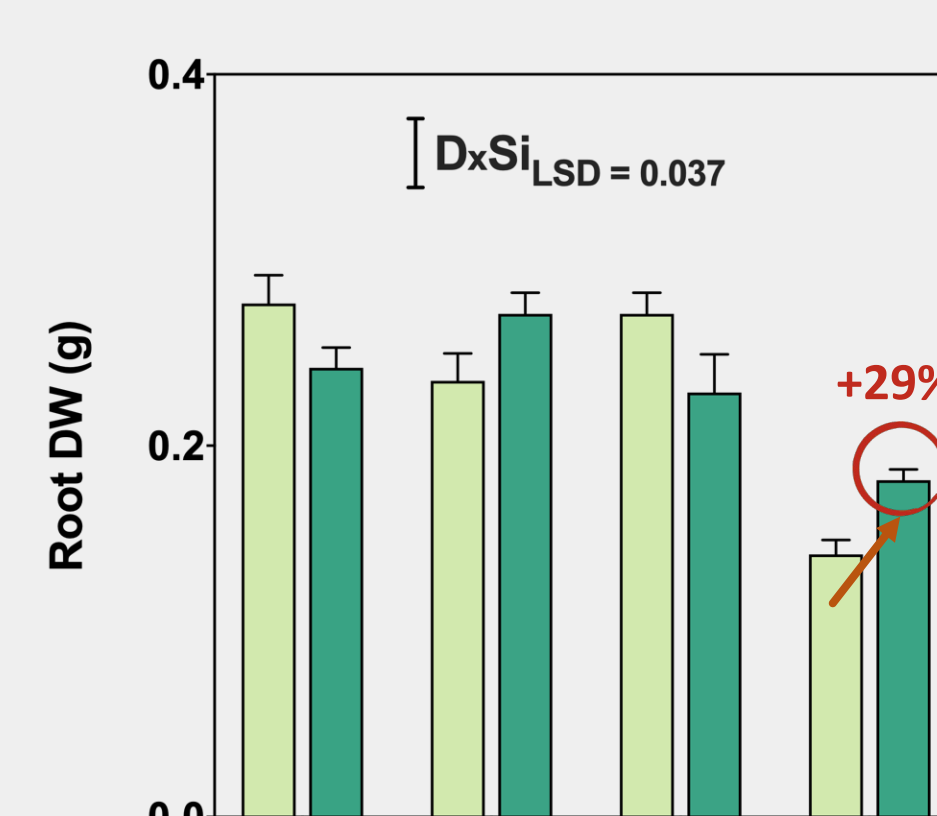
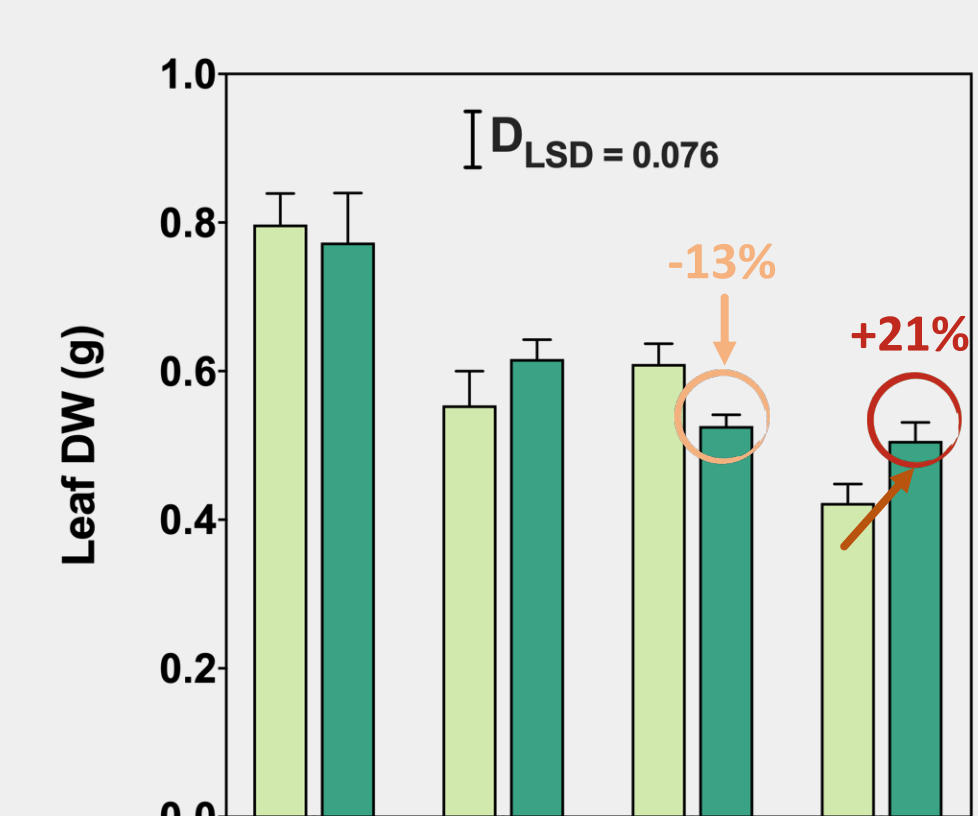
OR

2 mM Na₂SiO₃

RESULTS AND DISCUSSION

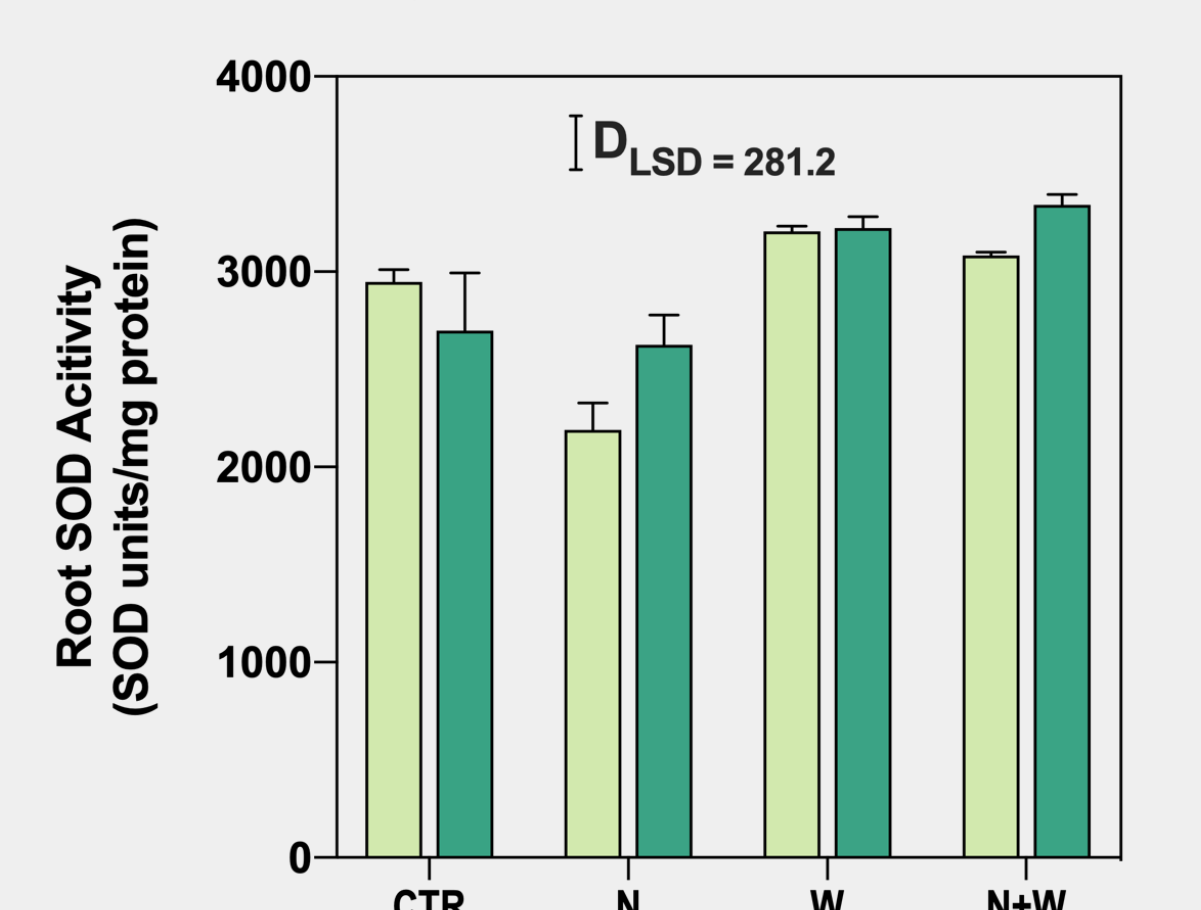
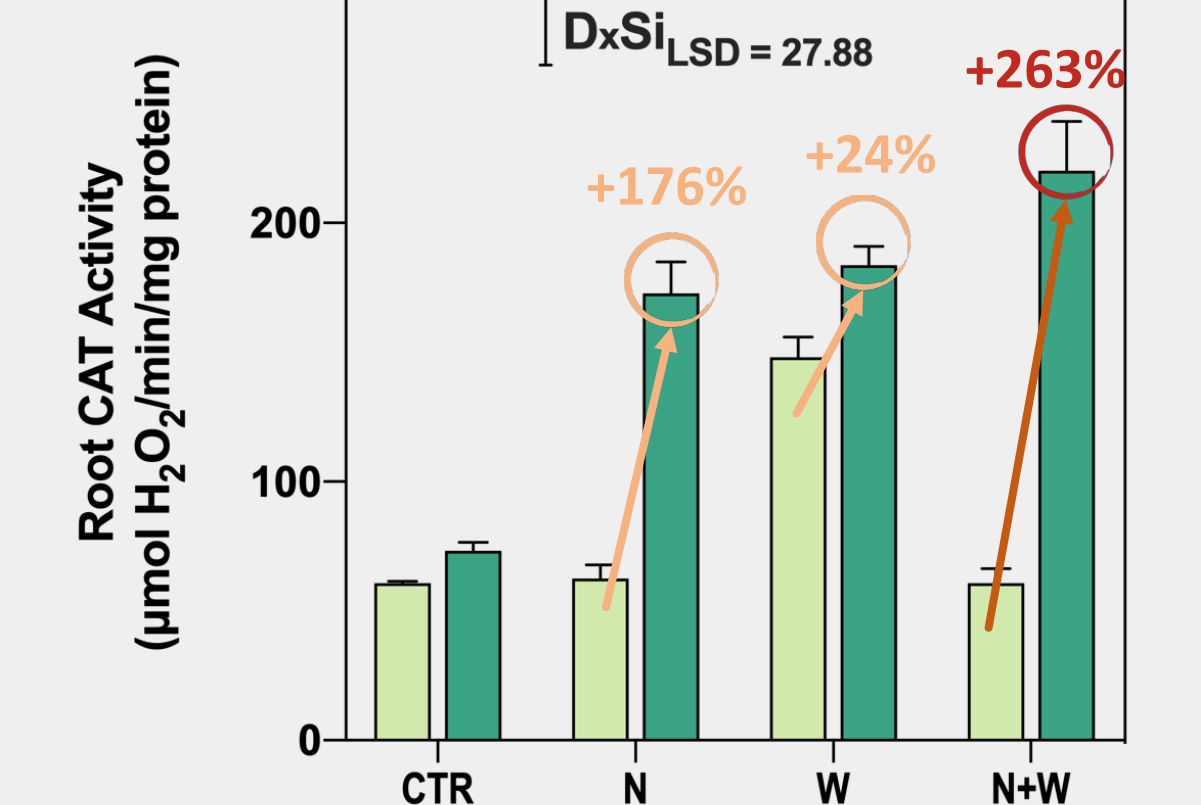
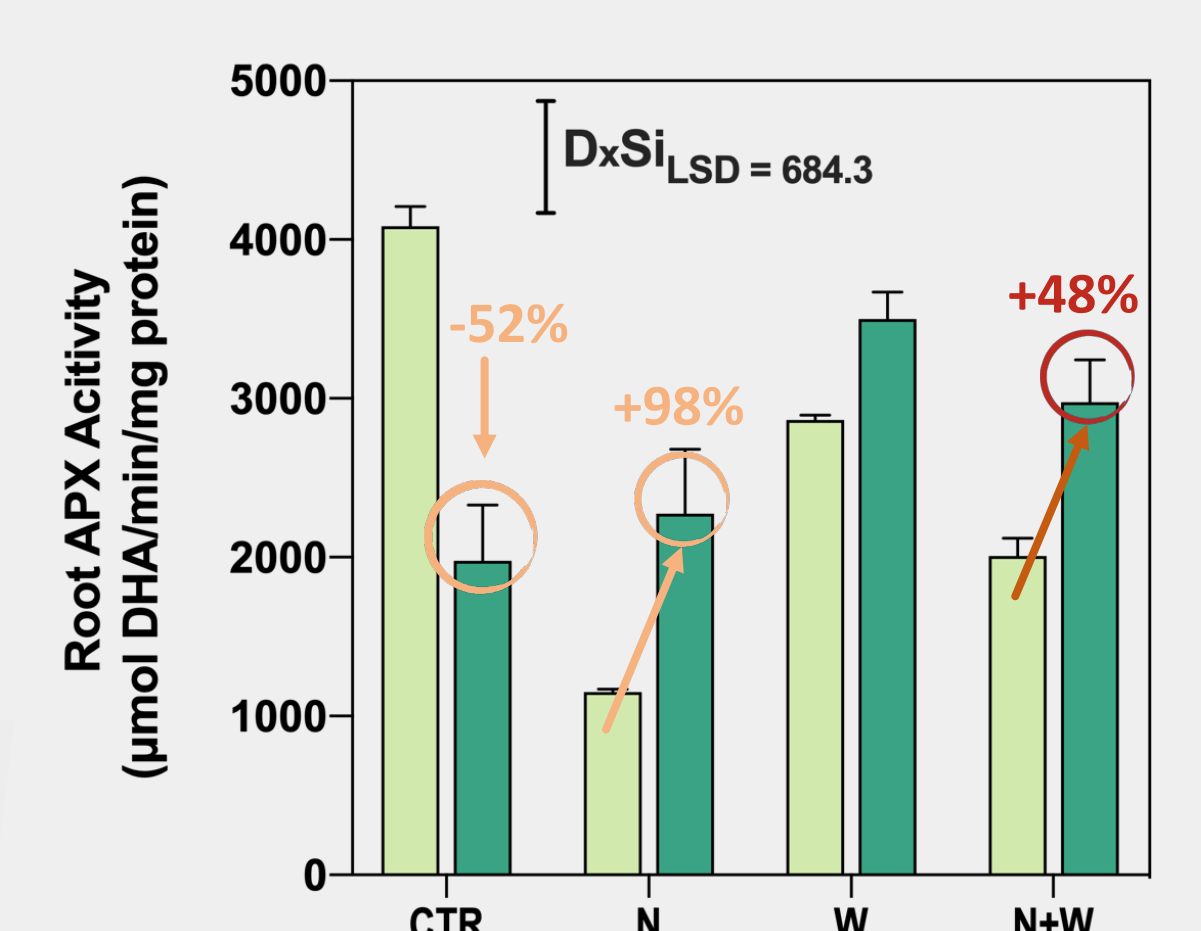


Si could mitigate some of the negative effects of N+W deficit



Better performance seems to be related, at least partly, to the root's AOX system

N+W deficit Si-treated tomato plants could efficiently modulate their AOX system



Plants' response to combined deficits cannot be extrapolated from the responses to the single deficits

CONCLUSIONS

- Si mitigated some of the adverse effects of combined N+W stress promoting several plant growth traits
- **N+W deficit Si-treated** tomato plants could **efficiently modulate their AOX system**
- **Better performance** seems to be related, at least partly, to the **root's AOX system**

These results are highly relevant if we consider that:

- plants often do not face only one single abiotic stress, but rather a combination of them
- combined stress was the treatment where the highest decreases in growth traits were found, and therefore the treatment where the application of Si would bring more benefits

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