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Enhancing salt stress tolerance in tomato (*Solanum lycopersicum L.*) through foliar silicon application

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INTRODUCTION & AIM

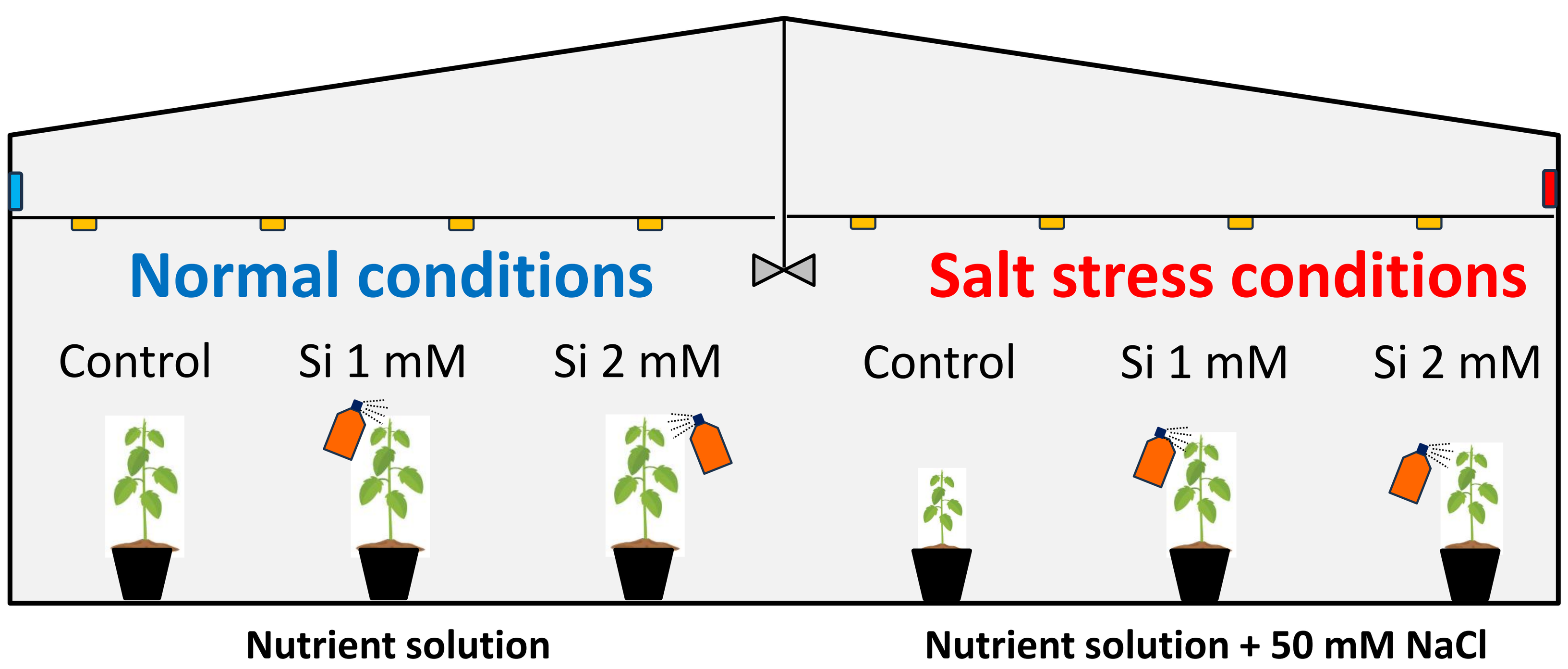
Due to damages caused by different biotic and abiotic stresses and due to the new regulations, agronomic yield and productivity is facing a delicate situation that requires seeking a balance to ensure its sustainability.

To achieve this goal, scientists and companies are seeking for solutions in the use of bioestimulants to reduce the effects of these plant stress [1].

In the last decades, the application of silicon (Si): improved resistance against pathogen attack, salinity, drought, improved plant immune system and improved nutrient uptake[2].

This study focuses on improving salt stress resistance in tomato plants through the foliar application of silicon in the form of Na_2SiO_3 solution in hydroponic culture.

METHODS



Each treatment was carried out by sextuplicate.

Parameters analyzed in leaves
- Dry weight and aerial part height
- Chlorophyll content
- Macro and micronutrient
- Catalase activity
- Total soluble sugars
- Malondialdehyde content
- Proline concentration

RESULTS & DISCUSSION

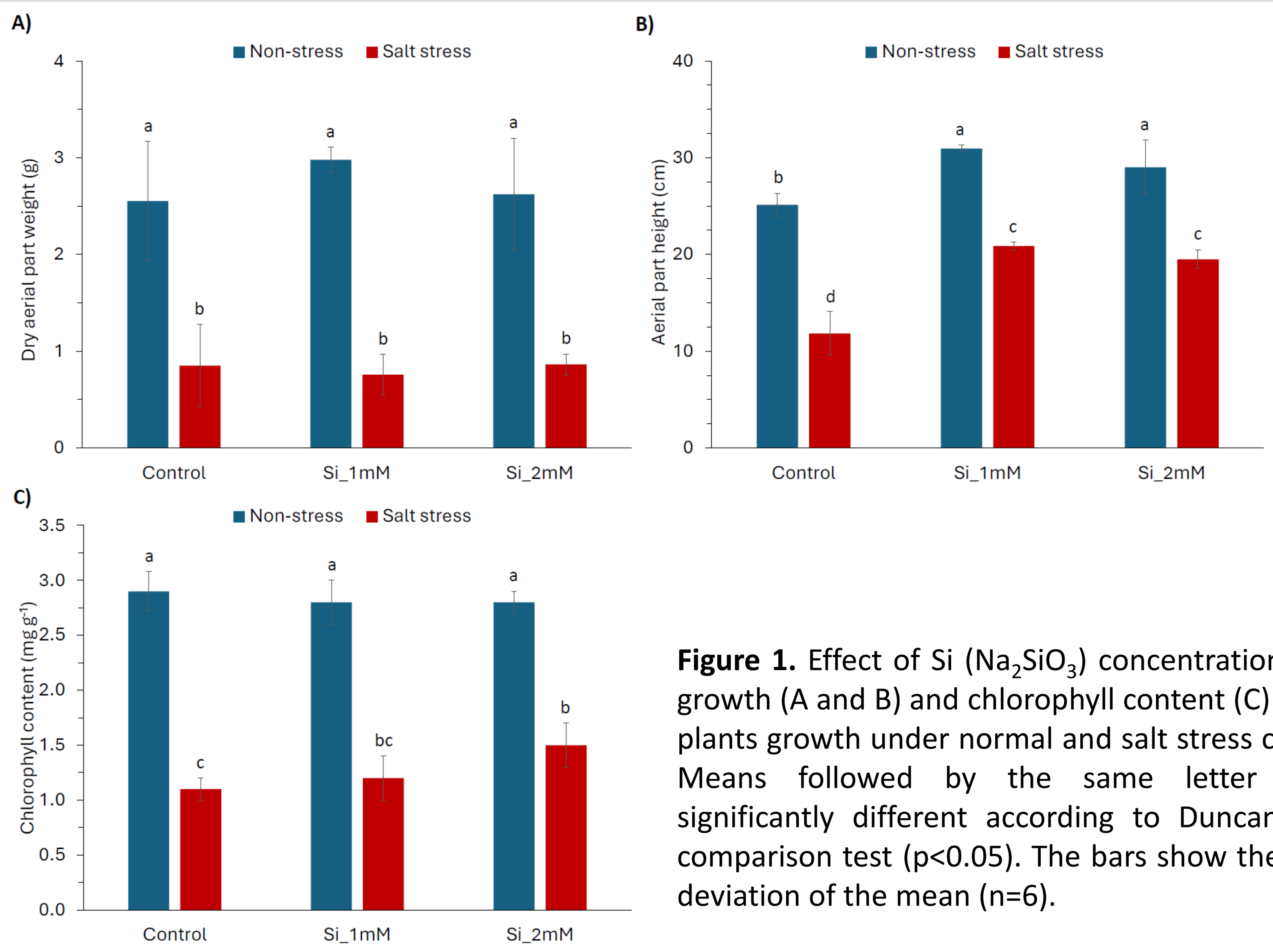


Figure 1. Effect of Si (Na_2SiO_3) concentration on plant growth (A and B) and chlorophyll content (C) in tomato plants growth under normal and salt stress conditions. Means followed by the same letter are not significantly different according to Duncan multiple comparison test (p<0.05). The bars show the standard deviation of the mean (n=6).

Table 1. Effect of salt stress (0 and 50 mM NaCl) and foliar application of Si (1 and 2 mM Na_2SiO_3) on nutritional parameters of hydroponically grown tomato plants. Means (n=6) followed by the same letter are not significantly different according to Duncan multiple comparison test (p<0.05). Sig is ns: sig>0.05; *: 0.01<sig<0.05; **: 0.001<sig<0.01; ***: sig<0.001.

Treatment	Non-stress			Salt stress			Sig.
Element	Control	Si_1mM	Si_2mM	Control	Si_1mM	Si_2mM	
Na (%)	0.18±0.02e	0.8±0.2d	1.80±0.07c	6.1±1.4a	3.5±0.7b	4.1±0.2b	***
K (%)	5.0±0.4a	4.9±0.3a	4.9±0.3a	2.7±0.6b	2.3±0.4b	2.4±0.4b	***
Mg (%)	0.46±0.08a	0.30±0.02b	0.31±0.03b	0.22±0.02d	0.17±0.04d	0.28±0.02c	***
Ca (%)	2.6±0.3a	2.3±0.2a	2.4±0.4a	1.30±0.05b	1.0±0.2b	1.3±0.3b	***
Fe (mg kg^{-1})	117±6c	109±7c	141.3±0.6a	90±4e	101±2d	134±4b	***
Cu (mg kg^{-1})	6.5±0.9a	5.5±1.5ab	6.9±1.1a	3.8±0.4bc	3.6±1.2c	4.1±0.5bc	***
Mn (mg kg^{-1})	111±8a	100±6ab	110±5a	54.1±1.3c	23.0±0.2e	27±2d	***
Zn (mg kg^{-1})	28±2a	22.9±1.3bc	23.7±1.4b	24±2b	15.7±0.5d	14.1±1.4e	***

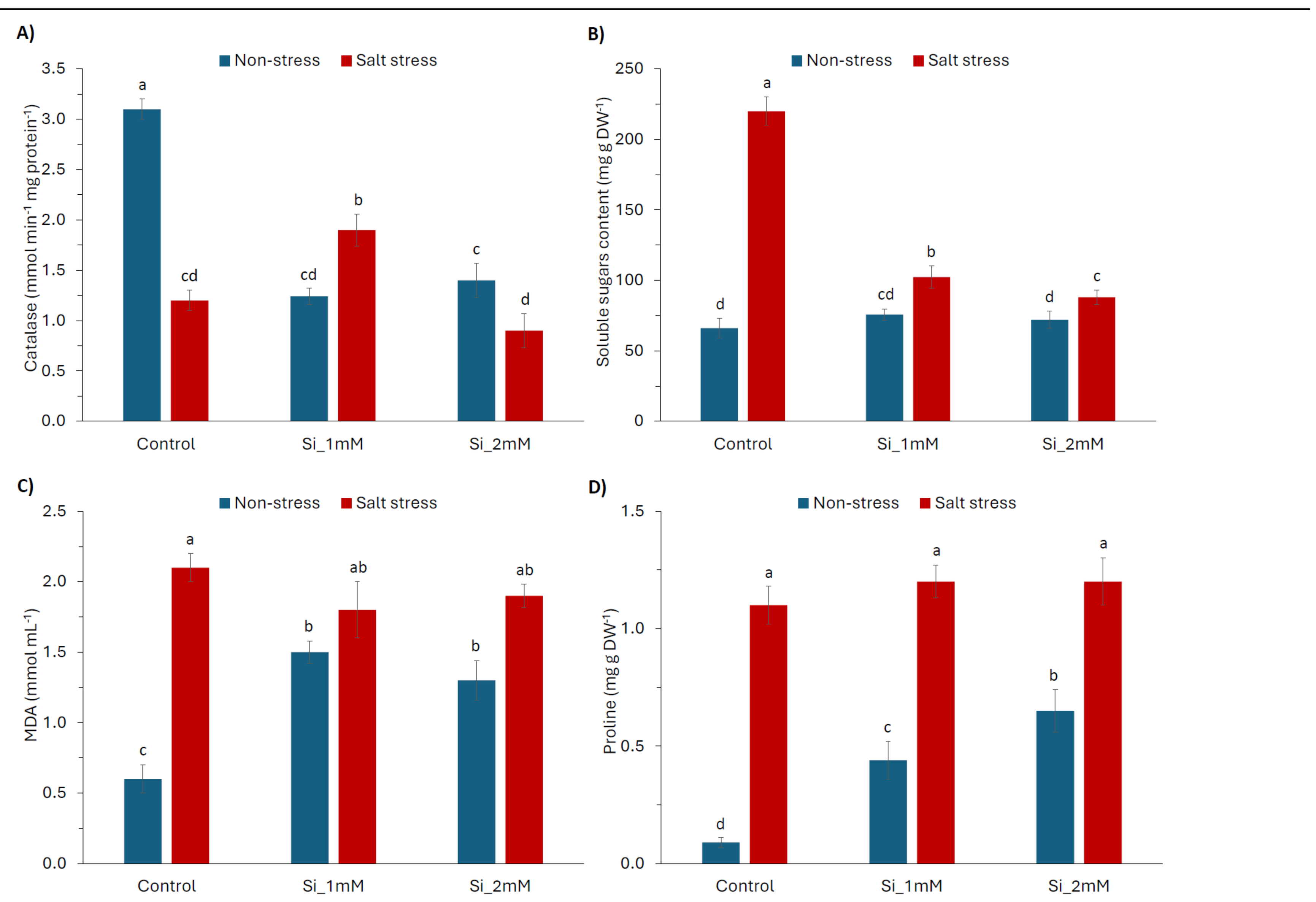


Figure 2. Effect of Si (Na_2SiO_3) concentration on catalase activity (A), soluble sugar content (B), MDA concentration (C) and proline content (D) in tomato plants growth under normal and salt stress conditions. Means followed by the same letter are not significantly different according to Duncan multiple comparison test (p<0.05). The bars show the standard deviation of the mean (n=6).

CONCLUSIONS

This research offers a promising strategy for enhancing salt tolerance in tomato plants, primarily through foliar Si application. The results underscore the importance of optimizing Si dosage to achieve the desired effect. Furthermore, this study provides a potential application of Si, emphasizing its importance in addressing the challenges posed by soil salinization in agriculture.

REFERENCES

[1] Sci Hortic 196, 3-14 (2015).
[2] Plant Growth Regul **100**, 301-319 (2023).