

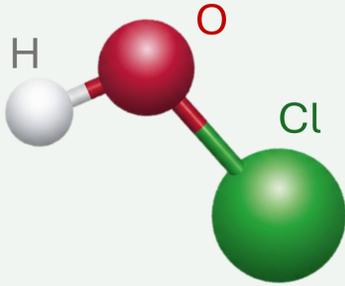
Hypochlorous acid as a tool for sustainable plant disease management

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Introduction

Sustainable disease management represents a fundamental component of resilient agroecosystems, enabling eco-friendly food production under the combined pressures of climate change and a rapidly increasing global population. Among emerging technologies to protect plant health, hypochlorous acid (HOCl) is gaining attention for its strong oxidizing properties, which make it an effective sanitizer and disinfectant. HOCl is unstable and rapidly degrades into H⁺ and OCl⁻ in aqueous solution without releasing toxic by-products, expanding its use in food safety, medical applications, and agricultural sterilization. Produced through electrochemical activation of water and NaCl, HOCl can be generated directly *in situ*.



Aim

Evaluate the effect of HOCl-treated water to improve plant health

Olea europaea

Can the hypochlorous acid reduce the population of *Pseudomonas savastanoi* pv. *savastanoi* (*Psv*), the causal agent of olive knot disease?

Plants were sprayed with HOCl until complete wetting of the olive tree canopy

Leaves were sampled 7 and 30 days after treatment and the presence of *Psv* was evaluated through molecular analyses

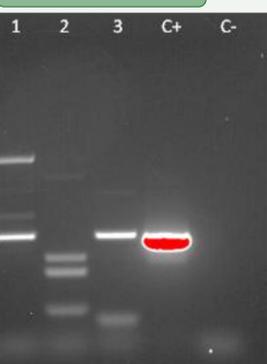
Solanum lycopersicum

How HOCl affect tomato plant growth and defenses under field conditions?

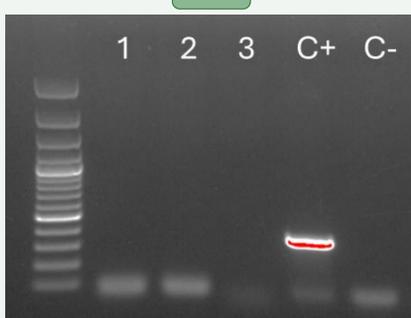
Plants were sprayed with 2,000 ppm or 200 ppm of HOCl until complete wetting of the aerial part. The treatment was repeated one per week

6-weeks after treatment, plants were harvested

Before treatment



7 dpt



30 dpt

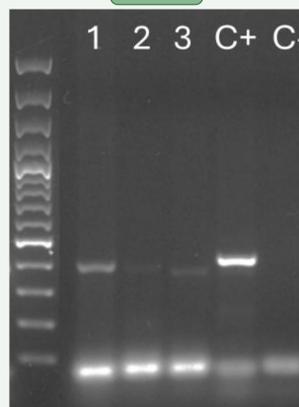


Figure 1 – End-point PCR results of three representative leaf samples (1 to 3) collected from olive trees sprayed with hypochlorous acid before treatment, 7 and 30 days post treatment (dpt). C+: Positive control, *Psv*. C-: Negative control of PCR reaction.

Results (Figure 1) showed a reduction of the epiphytic population of *Psv* one week after treatment (7 dpt), with a decrease in efficacy over time.

The antimicrobial activity of the hypochlorous acid could be enhanced by adopting repeated treatments throughout the production cycle, particularly during periods most favorable for infection development.

Conclusions

Overall, these findings suggest that, with appropriate management, HOCl could serve as an effective tool for sustainable crop protection. Further studies need to be carried out to completely understand the potential role of HOCl in plant health.

Analysis of physiological parameters

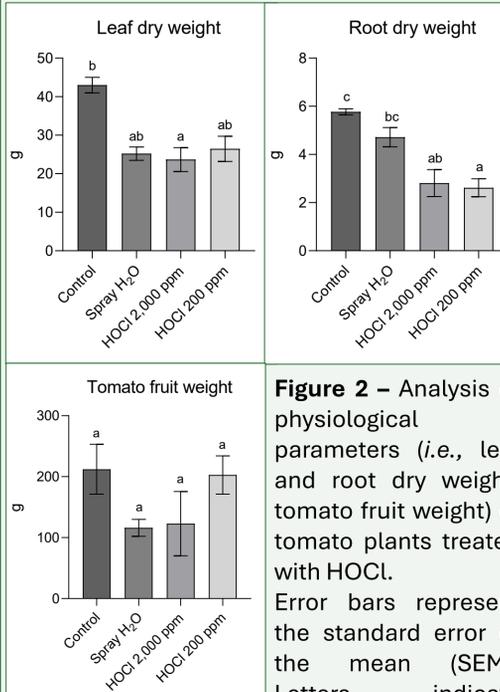


Figure 2 – Analysis of physiological parameters (i.e., leaf and root dry weight, tomato fruit weight) of tomato plants treated with HOCl. Error bars represent the standard error of the mean (SEM). Letters indicate statistically significant differences between treatments (p -value < 0.05).

Plants treated with 2,000 ppm HOCl showed reduced leaf dry weight, and both HOCl concentrations decreased root dry weight relative to controls (Figure 2). Notably, HOCl-treated plants exhibited a trend toward increased fruit weight compared with H₂O-sprayed plants.

Expression analysis of defense-related genes

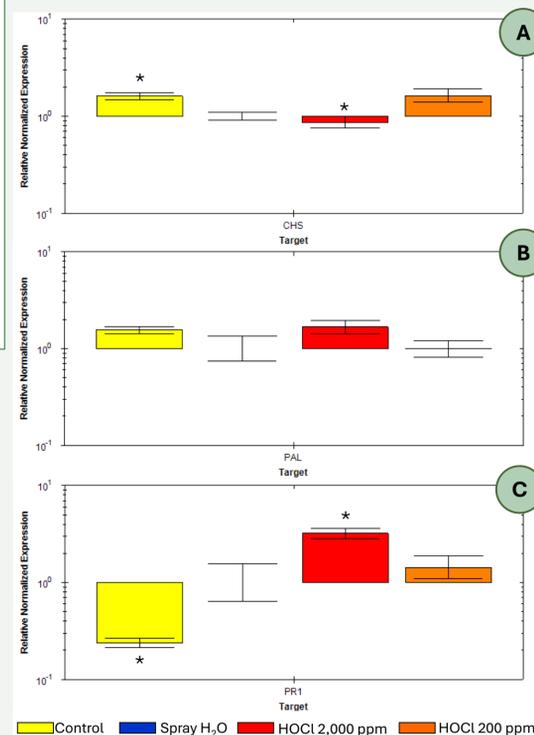


Figure 3 – Relative expression of defense-related genes: A) *CHS*, B) *PAL*, C) *PR1*. Error bars represent the SEM. * p -value < 0.05.

The application of 200 ppm HOCl induced *CHS* overexpression relative to the H₂O spray control. Moreover, weekly HOCl application enhances *PR1* expression, especially at 2,000 ppm, suggesting the activation of salicylic acid-mediated defense pathways.

Acknowledgments

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