



Fayoum University



Agric. Botany Department



Faculty of Agriculture

RESPONSE OF HOT PEPPER PLANT PERFORMANCE UNDER SALT STRESS CONDITIONS TO TREATMENT WITH CITRIC ACID

By

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**B.Sc. Agric. Sci., Fac. Agric., Plant Production Program (Horticulture), Fayoum
Univ., 2021**

A THESIS

**Submitted in Partial Fulfillment of
The Requirements for the Degree of**

MASTER OF SCIENCE

IN

**Agricultural Sciences
(Plant Physiology)**

Agric. Botany Department

Faculty of Agriculture

Fayoum University

EGYPT

2025



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ABSTRACT

Foliar treatment with citrate (CA), a natural organic acid, is essential for mitigating salt stress damage and helps plant physiology and metabolism respond effectively under stressful conditions. Nano-supplements have revolutionized the delivery of plant requirements more effectively than conventional systems. Therefore, this is the first research to investigate the effects of foliar spraying with nano-CA (n-CA) and conventional CA (c-CA) on physio-biochemical, osmo-stress relievers (OS-Rs), total antioxidant capacity (TAC), total antioxidant activity (TAA), enzyme gene expression, productivity, and fruit quality responses in hot pepper plants exposed to salt stress ($EC_e = 8.5 \text{ dS m}^{-1}$) during two seasons (2023 and 2024). Under stress conditions, n-CA or c-CA application noticeably improved plant physio-biochemical-related components, including photosynthesis, leaf fitness, gas exchange, nutritional and hormonal status, K^+/Na^+ ratio, and OS-Rs. Similarly, ascorbate and glutathione content and redox state, enzyme activity, TAA, and relative expressions of *SOD*, *CAT*, *POD*, and *APX* enzyme genes were markedly improved by n-CA or c-CA application. Conversely, oxidant indicators ($O_2^{\bullet-}$ and H_2O_2), oxidative damage indices (electrolyte leakage and malondialdehyde content), and Na^+/K^+ ratio were noticeably reduced by n-CA or c-CA treatment. These positive findings reflect an increase in plant growth, production, and fruit quality components. The best application concentrations of n-CA and c-CA were 0.4 and 4.0 mM, respectively, with n-CA noticeably outperforming c-CA. This indicates the pivotal role of n-CA in enhancing plant defense mechanisms against salinity effects, providing a viable agronomic strategy to improve crop resilience to saline conditions.

Keywords *Capsicum annuum* L.; abiotic stress; physio-biochemical responses; photosynthesis; fruit quality; gene expression