imagery, creating platforms where temperature-yield modules for tomato become part of a larger cyber-physical production system. Knowledge-based data-driven approaches that couple calibrated process-based models with deep learning show one promising route: process models preserve interpretability and physiological realism, while neural networks and particle filtering correct systematic errors and adapt to new microclimates or management regimes. At the same time, IoT reviews highlight persistent challenges around sensor accuracy, interoperability, and deployment cost, suggesting that future climate-adaptive modeling must explicitly handle data quality, uncertainty propagation, and robust control under extreme events. In this context, next-generation temperature-yield models will need to be both explainable and self-updating, closing the loop between sensing, prediction, and actuation to support resilient, low-carbon greenhouse tomato systems under a changing climate.

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Conflict of Interest Disclosure

The author affirms that this research was conducted without any commercial or financial relationships that could be construed as a potential conflict of interest.

References

Abid H., Zghal O., Lajnef M., Ketata A., Zouari S., Gugliuzza G., Mejri M., Arrabito E., and Driss Z., 2024, Analysis of seasonal variations and their impact on the microclimate of soilless glass greenhouses: numerical and experimental investigations, Numerical Heat Transfer Part A: Applications, 86(4): 4576-4600.
https://doi.org/10.1080/10407782.2024.2320829

Alsamir M., Mahmood T., Trethowan R., and Ahmad N., 2020, An overview of heat stress in tomato (*Solanum lycopersicum* L.), Saudi Journal of Biological Sciences, 28(3): 1654-1663.
https://doi.org/10.1016/j.sjbs.2020.11.088

Avasiloaiei D., Calara M., Brezeanu P., Bălăiță C., Brumă I., and Brezeanu C., 2025, Optimizing tomato yield and quality in greenhouse cultivation through fertilization and soil management, Agronomy, 15(9): 2045.
https://doi.org/10.3390/agronomy15092045

Bazgaou A., Fatnassi H., Bouharroud R., Ezzaeri K., Gourdo L., Wifaya A., Demrati H., Elame F., Carreño-Ortega Á., Bekkaoui A., Aharoune A., and Bouirden L., 2021, Effect of active solar heating system on microclimate, development, yield and fruit quality in greenhouse tomato production, Renewable Energy, 165: 237-250.
https://doi.org/10.1016/j.renene.2020.11.007

Belouz K., Nourani A., Zereg S., and Bencheikh A., 2022, Prediction of greenhouse tomato yield using artificial neural networks combined with sensitivity analysis, Scientia Horticulturae, 291: 110666.
https://doi.org/10.1016/j.scienta.2021.110666

Boote K.J., Rybak M.R., Scholberg J.M.S., and Jones J.W., 2012, Improving the CROPGRO-Tomato model for predicting growth and yield response to temperature, HortScience, 47(8): 1038-1049.
https://doi.org/10.21273/HORTSCI.47.8.1038

Dash P., Guo B., and Leskovar D.I., 2023, Optimizing hydroponic management practices for organically grown greenhouse tomato under abiotic stress conditions, HortScience, 58(11): 1378-1386.
https://doi.org/10.21273/HORTSCI17249-23

Efeta B., D'arc U., Claude S., Pancras N., and Jonathan M., 2025, The influence of temperature difference on crop physiological process: Systematic growth analysis of *Solanum lycopersicum* (tomatoes) in both greenhouse and open field, East African Journal of Agriculture and Biotechnology, 8(2): 1-13.
https://doi.org/10.37284/eajab.8.2.3973

Fanourakis D., Tsaniklidis G., Makraki T., Nikoloudakis N., Bartzanas T., Sabatino L., Fatnassi H., and Ntatsi G., 2025, Climate change impacts on greenhouse horticulture in the Mediterranean Basin: Challenges and adaptation strategies, Plants, 14(21): 3390.
https://doi.org/10.3390/plants14213390

Flores-Velázquez J., Rojano F., Aguilar-Rodríguez C., Villagran E., and Villarreal-Guerrero F., 2022, Greenhouse thermal effectiveness to produce tomatoes assessed by a temperature-based index, Agronomy, 12(5): 1158.
https://doi.org/10.3390/agronomy12051158

Ghabileh M., Lotfi M., Aliniaeifard S., and Ramshini H., 2024, Variation in reproductive organ functionality among a population of tomato genotypes reveals the importance of pollen viability and fruit set in response to heat stress, International Journal of Vegetable Science, 30(6): 717-731.
https://doi.org/10.1080/19315260.2024.2429118