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Determination of Watering Regime for Optimal Production of Hortitom 1 and Hortitom 3 Genotypes of *Solanum lycopersicum* L. (Tomatoes) under Screenhouse Conditions

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Abstract Water availability is a major limiting factor for tomato production, particularly under changing climate conditions. This study investigated the effects of eight watering regimes twice daily (T1), once daily (T2), every 2 days (T3), every 3 days (T4), every 4 days (T5), every 5 days (T6), every 6 days (T7), and continuous waterlogging (T8) on growth, yield, and fruit nutritional quality of two Nigerian tomato genotypes (Hortitom 1 and Hortitom 3) under screenhouse conditions. The experiment was laid out in a 2 × 8 factorial arrangement in a completely randomized design with five replicates. Both genotypes exhibited 100% survival under all non-waterlogged treatments, while continuous waterlogging (T8) resulted in 100% mortality. Hortitom 1 and Hortitom 3 attained their maximum plant height at T5 (watering every 4 days), recording 58.70 cm and 62.50 cm respectively. Fruit yield (fresh weight) was highest in Hortitom 1 under T1 (5.25 g per fruit) and in Hortitom 3 under T7 (7.75 g per fruit). Nutritional composition was significantly influenced by genotype and watering regime. Crude protein content peaked at 2.06% in Hortitom 1 under T5 and 1.85% in Hortitom 3 under T4. These results demonstrate clear genotypic differences in response to water availability. Hortitom 1 performed best under moderate water stress (T5) for vegetative growth and nutritional quality, while Hortitom 3 showed superior fruit yield under more severe water restriction (T7). Both genotypes are highly susceptible to waterlogging but tolerant to drought. The findings provide genotype-specific irrigation recommendations that can enhance water-use efficiency while maintaining or improving fruit nutritional quality in tomato production under screenhouse conditions.

Keywords Drought; Waterlogging; Tomato genotypes; Growth; Nutritional quality; *Solanum lycopersicum*

1 Introduction

Tomato (*Solanum lycopersicum* L.) is one of the most widely cultivated and consumed vegetables worldwide. It is valued for its rich nutritional profile, including vitamins A, C, and E, as well as lycopene antioxidants that reduce risks of cardiovascular diseases and cancers (Bai and Lindhout, 2022; Natali et al., 2025). The crop also plays key economic and industrial roles. Native to western South America, particularly Peru and Ecuador, tomatoes were domesticated in Mexico. Spanish explorers introduced them to Europe in the 16th century. Initially grown as ornamentals due to their resemblance to nightshade plants, they later became a global culinary staple (Donoso et al., 2022).

Tomatoes exhibit extensive morphological and genetic diversity. This diversity has produced genotypes adapted to various climates, diseases, and consumer preferences. Wild relatives contribute key traits, such as drought and salinity resistance from *Solanum pimpinellifolium*. Other species, including *S. peruvianum*, *S. chilense*, *S. habrochaites*, and *S. pennellii*, provide tolerances to extreme conditions, pathogens, pests, and cold (Razifard et al., 2020; Blanca et al., 2022).

Successful tomato cultivation depends on optimal environmental and agronomic factors. Well-drained loamy soils with pH 5.5-6.8 and high organic matter support root health, nutrient uptake, and disease prevention (Jones, 2021). Clay soils hinder drainage, while sandy soils require irrigation and amendments. Ideal temperatures range from 20°C to 25°C for growth, flowering, and fruiting. High temperatures (>30°C) cause flower abortion, and low