Colegio de Postgraduados

Response of Tomato (*Solanum lycopersicum* L.) Genotypes

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ABSTRACT

Objective: To evaluate seven different saladette tomato genotypes (*Solanum lycopersicum* L.) in southern Tamaulipas, Mexico.

Design/methodology/approach: The evaluation was conducted using a randomized block design with three replications. Yield and fruit characteristics were assessed. The data obtained were analyzed using Tukey's mean comparison test ($P \leq 0.05$) with the SAS statistical software.

Results: The Elsa tomato hybrid exhibited a yield above the average recorded in Tamaulipas in recent years. Although the other genotypes showed lower yields, they exhibited fruit quality characteristics required for the fresh-market segment of this crop.

Findings/conclusions: The genotype recommended for the southern region of Tamaulipas is Elsa, as it achieved the highest yield and produced fruits of average size and weight.

Keywords: Yield, fruit quality, *Solanum lycopersicum*.

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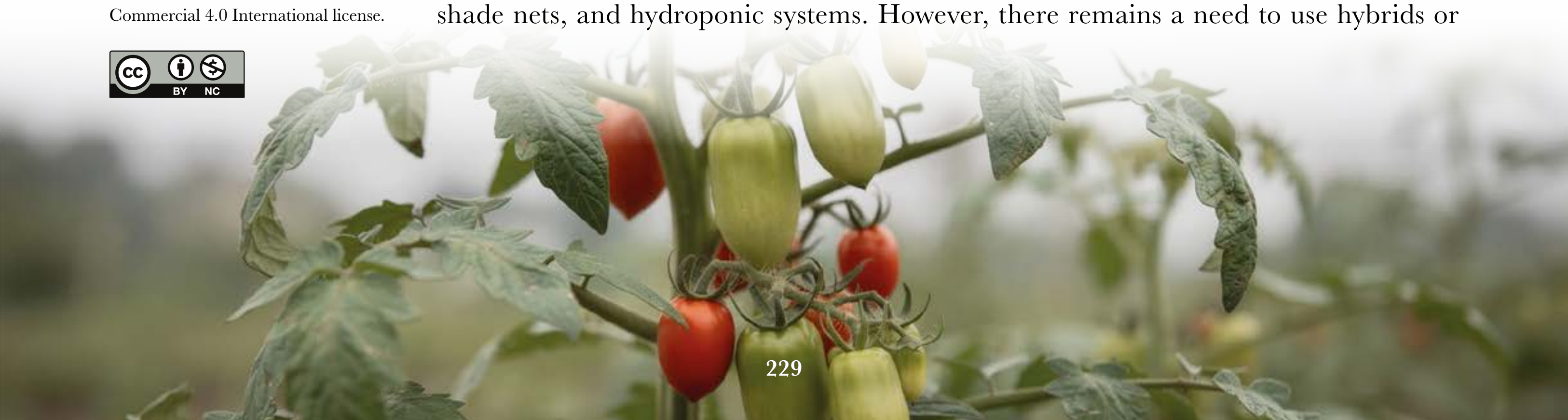
INTRODUCTION

Tomato (*Solanum lycopersicum* L.) is an important vegetable crop, as it is cultivated in nearly all parts of the world (Srinivas *et al.*, 2019). In 2023, Mexico produced 3,636,927.46 t; the main producing states were Sinaloa, San Luis Potosí, Michoacán, and Jalisco, while in the state of Tamaulipas production reached 17,258.13 t (SIAP, 2024). This fruit is highly relevant in the gastronomic culture of many countries, including Mexico, as it can be consumed fresh or processed. Its quality depends on the management practices and the conditions under which the crop develops (Coyago-Cruz *et al.*, 2018). Food products derived from tomato are considered healthy because they are low in calories and fat, free of cholesterol, and are a source of fiber and protein (Waliszawski *et al.*, 2010). Given the importance of this crop, various production technologies have been incorporated into tomato cultivation, such as greenhouses, shade nets, and hydroponic systems. However, there remains a need to use hybrids or



varieties that can optimize the benefits of these technologies despite adverse climatic conditions. Therefore, it is crucial to identify genotypes that adapt well to the prevailing climatic conditions of each production area, as this will allow the yield potential of the material to be fully exploited and, consequently, increase yields per unit area (Santiago and Borrego, 2016).

The performance of a genotype under protected conditions does not necessarily correspond to its performance in open-field environments, since climatic conditions cannot be controlled in the field. Moreover, substantial variation may occur in the behavior of a genotype across different environments due to differences in altitude, location, level of technological input, and environmental conditions, among other factors; therefore, results from one environment cannot be extrapolated to another. Consequently, it is advisable to conduct trials with different genotypes in the region of interest in order to select the one that performs best in that locality, while also considering the target market for the production (Castellanos, 2009). For this reason, the objective of this study was to evaluate seven different saladette tomato genotypes under the environmental conditions of southern Tamaulipas.

MATERIALS AND METHODS

Location of the experiment. The study was conducted at the facilities of the Las Huastecas Experimental Station of the National Institute for Forestry, Agricultural and Livestock Research, located at Km 55 of the Tampico-Mante Highway in Villa Cuauhtémoc, Altamira, Tamaulipas. The site is situated at coordinates 22° 33' 59" N and 98° 09' 49" W, within the Huasteca region, at an elevation of 11 masl.

Land preparation

The field was plowed with a disc plow to a depth of 30 cm and left to rest for 30 days. Subsequently, harrowing and leveling were performed, and the beds were formed with a spacing of 1.84 m between them.

Seedling preparation and transplanting

Seven saladette tomato genotypes were used: 3382, 6653, 8444, Duramax, Elsa, Gabby, and TM1019. Seeds were sown in 200-cell polystyrene trays using peat moss as the substrate. Transplanting was carried out 30 days after sowing, placing the plants at a distance of 60 cm apart in single rows. Irrigation was provided through drip lines with a 6-mil tape, spaced 20 cm between emitters. Continuous monitoring was conducted for pest and disease management, and fertigation was applied according to the crop's requirements at each phenological stage.

Experimental design

A randomized complete block design with three replications was used. Each experimental plot consisted of a bed 1.84 m wide and 4.0 m long. Harvesting was conducted in the central 3.0 m of the bed, resulting in a net plot area of 5.52 m^2.

Variables evaluated

Total yield (t ha^{-1}) and fruit characteristics were evaluated, including fruit weight, length, diameter, placenta filling, pericarp thickness, number of locules, and °Brix. The data obtained were subjected to analysis of variance, and mean comparisons were performed using Tukey's test ($P \leq 0.05$) with the support of SAS statistical software, version 9.4.

RESULTS AND DISCUSSION

According to the general analysis of variance, significant differences were found for the measured variables, and therefore, Tukey's mean comparison test ($P \leq 0.05$) was applied.

Fruit weight is closely related to several parameters, such as the number of carpels in the ovary, the position of the fruit on the cluster, and the prevailing environmental conditions during the fruit growth phase (Delgado-Vargas *et al.*, 2018), as well as the supply of photoassimilates and water, which determine its growth and development (Quinet *et al.*, 2019). The heaviest fruits were obtained in genotype 3382, with an average weight of 138.08 g (Table 1). This genotype falls within the high-quality size range, as indicated by PHG (2012) in its tomato fruit classification, which considers fruits weighing between 121 and 180 g as large.

Fruit size is a highly important characteristic for farmers, as it allows product standardization and classifies the fruit within the higher size categories, thereby adding value to the harvest. This classification is carried out according to the CODEX standards. In this context, genotype 3382 exhibited the largest fruit size (13.61 cm). Jerez-Mampie *et al.* (2023), in a study conducted with saladette tomato, reported fruit sizes ranging from 3.33 to 6.08 cm. These values are lower than those obtained in the present study, where fruit sizes ranged from 6.06 to 13.61 cm. However, regarding fruit diameter, values ranged from 4.38 to 5.77 cm, placing them in category 6, whereas the fruits in the study by Jerez-Mampie *et al.* (2023) were classified in categories 7, 8, and 9 out of a total of 10. The increase in tomato fruit diameter occurs due to the growth in cell mass and number, unlike fruit shape, which is determined at fruit set and is variety-dependent (Casierra *et al.*, 2007). Regarding other characteristics, the genotype that exhibited the greatest pericarp thickness was TM1019, with 0.77 cm. In a study by Ramos *et al.* (2021), pericarp thickness values ranged from 0.8 to 0.9 cm, indicating that their fruits had thicker pericarps than those obtained in the present study, which showed lower values. According to Gan *et al.* (2022), fruits with thicker pericarps are more likely to have a longer postharvest life, which is essential for commercialization. This indicates that the fruits obtained in the present study are likely to have a shorter shelf life, a period during which the fruit can maintain its properties such as nutrients, flavor, texture, and color. Quinet *et al.* (2019) mention that fruits with thicker pericarps exhibit an increase in edible portion and fruit weight. Regarding the number of locules, three genotypes stood out: 8444 (3.78), Duramax (3.67), and Elsa (4.00), as shown in Table 1. Vázquez-Ortiz *et al.* (2010) reported saladette tomato fruits with an average of three locules, which is similar to the results obtained in this study. These authors also noted that fruit shape is closely linked to the number of locules. However, changes in fruit shape can produce pleiotropic effects on fruit formation, such as those associated with increases in carpels and locules (Lippman and Tanksley, 2001). Maldonado *et al.* (2023) evaluated different tomato genotypes under field conditions, and among the materials assessed, hybrids 1 and 2 had an average of two locules, which is lower than the values obtained in the present study.

Regarding °Brix, most genotypes showed statistically similar values, except for genotypes 3382 and TM1019, which exhibited the lowest concentrations (Table 1). The normal °Brix range for saladette tomato is between 3.5 and 5.0 (García *et al.*, 2010), which is lower than the values obtained in the present study (5.30 to 6.79 °Brix). Higher total soluble solids concentrations are associated with an increased capacity for nutrient transport and absorption (Cíntora-Martínez *et al.*, 2021) and are considered a key component of nutritional quality. Martínez-Rodríguez *et al.* (2017) reported that for round tomatoes, °Brix values should exceed 4 to fall within the range suitable for fresh consumption. Torre *et al.* (2015) noted that tomatoes for industrial processing should have °Brix values above 5, which exceeds the requirement for the fresh-market tomato. Ramos *et al.* (2021), in their fruit quality analyses, reported average °Brix values of 3.9, which are lower than those obtained in the present study. There is a direct relationship between °Brix values and fruit flavor (Quinet *et al.*, 2019); that is, higher °Brix content corresponds to greater flavor intensity (Cheng *et al.*, 2020).

Table 1. Mean comparison of the evaluated variables.

Genotype	Fruit weight (g)	Fruit length (cm)	Fruit diameter (cm)	Placental filling (cm)	Pericarp thickness (cm)	Number of locules	Brix degrees	*Yield t ha^{-1}
3382	138.08 a	13.61 a	5.77 a	4.21 a	0.72 ab	3.11 ab	5.37 b	32.77 e
6653	118.94 ab	7.16 b	5.44 ab	3.91 a	0.74 ab	3.33 ab	6.17 a	42.07 c
8444	116.22 ab	6.77 b	5.37 ab	3.85 ab	0.69 ab	3.78 a	6.26 a	47.56 b
Duramax	105.53 bc	6.59 b	5.41 ab	3.86 ab	0.71 ab	3.67 a	6.42 a	34.73 d
Elsa	102.62 bc	6.77 b	5.20 ab	3.84 ab	0.58 b	4.00 a	6.79 a	50.89 a
Gabby	96.40 bc	6.51 b	4.93 b	3.37 b	0.72 ab	3.22 ab	6.55 a	47.86 b
TM1019	85.99 c	6.06 b	4.38 b	3.36 b	0.77 a	2.33 b	5.30 b	21.87 f

Means with the same letter within a column are not statistically different (Tukey, α=0.05); *Yield (t ha^{-1}) is based on data from five harvests.

Figure 1. Fruit characteristics of the Elsa hybrid.

The analysis of variance indicated significant differences in yield, with the Elsa hybrid standing out with a production of 50.80 t ha^{-1} (Table 1). Yield is a highly variable trait, depending on environmental conditions and genotype (Monge, 2015). For tomatoes grown under open-field conditions, normal yields are estimated to range between 50 and 60 t ha^{-1} (Monardes, 2009). In the present study, the highest yield was achieved by the Elsa genotype, reaching just 50 t ha^{-1}, while the other evaluated materials fell below this value. Ramos *et al.* (2021) reported yields of 37.8 t ha^{-1} in their study, which is within the range observed in the present research.

CONCLUSIONS

The genotype recommended for the southern region of Tamaulipas is the Elsa hybrid, as it is a material that produces high yield and fruit quality, with large size and high weight.

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