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COMPARATIVE ASSESSMENT OF LOCAL TOMATO VARIETIES UNDER ORGANIC AND CONVENTIONAL CULTIVATION

*Aglaia Liopa-Tsakalidi and Kleopatra Giannopoulou

Department of Agriculture, University of Patras, GREECE.

*Corresponding Author

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ABSTRACT

This study comparatively assessed the performance of three local Greek tomato varieties—'Chios', 'Milo', and 'Grentza'—under organic and conventional cultivation systems. The research evaluated phytometric (plant growth), reproductive (flowering and fruiting), and qualitative (fruit characteristics) parameters to determine varietal adaptability and system efficiency. Organic cultivation significantly enhanced vegetative growth, with 'Chios' and 'Milo' exhibiting 85% and 166% increases in fresh plant weight, respectively, compared to conventional farming. Reproductive performance varied: 'Chios' produced 159% more fruits under organic management, whereas 'Grentza' showed higher fruit quality (↑ °Brix) but reduced yield (-77%). Fruit quality traits, including soluble solids and average fruit weight, were generally superior in organic systems, suggesting improved nutritional and organoleptic properties. The findings highlight genotype-dependent responses, with 'Chios' and 'Milo' demonstrating strong suitability for organic production, while 'Grentza' may require tailored management. This study underscores the potential of local varieties in sustainable agriculture, balancing yield and quality while conserving agrobiodiversity.

Keywords: Organic farming, conventional farming, local tomato varieties, agrobiodiversity, fruit quality, sustainable agriculture.

1. INTRODUCTION

The Solanaceae family is one of the most important plant families globally, including many species of significant economic and nutritional value. This family comprises staple food crops such as tomato (Solanum lycopersicum L.), eggplant (Solanum melongena L.), potato (Solanum tuberosum L.), and pepper (Capsicum annuum L.), which are fundamental to human nutrition and agricultural production (Daunay & Laterrot, 2007; Pickersgill, 2007). In addition to widely cultivated species, the family includes smaller, endemic, or wild species found in Greece. Originating from the Americas, these plants were introduced to Europe in the 16th century and to Greece in the 19th century. Morphologically, Solanaceae include herbaceous plants, shrubs, and trees with diverse fruits (Simpson, 2017) and belong to the order Solanales.

The tomato (Solanum lycopersicum L.) is one of the most widely cultivated vegetables globally, originating from the region of Mexico. It was introduced to Europe in the 16th century and to Greece in 1818. The wild forms L. pimpinellifolium and L. cerasiforme are considered its ancestors. It is primarily a self-pollinating plant with a diploid chromosome number (2n=24) (Olympios, 2015).

Botanically, the tomato is a herbaceous plant with three types of stem growth (indeterminate, determinate, and semi-determinate), compound leaves, flowers arranged in inflorescences, and berry-type fruits. The decoding of its genome in 2012 (Tomato Genome Consortium, 2012) was pivotal for scientific understanding and plant breeding.

Tomatoes thrive in warm and sunny environments, exhibiting drought resistance but not frost tolerance. Temperatures above 30°C reduce fruit set, while temperatures below 12°C inhibit growth. The production cycle ranges from 80 to 120 days and requires medium-textured, well-drained soils rich in organic matter.

Tomato cultivation is primarily based on high-yield hybrids, while the use of traditional local varieties remains limited. Despite advances in plant breeding that have enhanced genetic diversity, organic farming plays a crucial role in conserving local populations (Terzopoulos & Bebeli, 2010). Specifically, the National Plant Genetic Resources Register records 95 tomato varieties, while the National Genetic Material Bank includes approximately 300 local populations (Mellidou et al., 2020; Thomas et al., 2012).

Agricultural production has evolved from natural to intensive with the Green Revolution, introducing high inputs (fertilizers, pesticides) and monocultures, creating the conventional farming model (Food and Agriculture Organization of the United Nations [FAO], 2021). Despite maximizing yields, this system leads to the degradation of natural resources (soil, water) and health risks due to pesticide residues (FAO, 2021). The new Common Agricultural Policy (CAP) of the European Union promotes reducing pesticide and fertilizer use, strengthening organic farming, and implementing sustainable agricultural practices (European Parliament, 2022). Organic farming is an integrated production system that promotes sustainability, ecological balance, and food safety, avoiding synthetic chemical inputs (IFOAM - Organics International, 2008; Gamage et al., 2023). Its core principles include maintaining soil health, biodiversity, and adapting cultivation practices to local conditions. The EU regulatory framework, starting with Regulation 2092/91 and later replaced by Regulation 834/2007, is currently governed by Regulation 2018/848, ensuring standardization and certification of organic products through third-party systems (Council Regulation (EEC) No. 2092/91, 1991; Council Regulation (EC) No. 834/2007, 2007; Regulation (EU) 2018/848, 2018; Barlagne et al., 2023).

The Importance of Agrobiodiversity and Local Varieties

The interaction between humans and nature determines biodiversity. Cultural diversity is linked to biological diversity, as conserving local varieties protects agroecosystems and cultural identities (Santilli, 2009). In this context, agrobiodiversity plays a central role in maintaining the functionality of agroecosystems (Zimmerer, 2000). Sustainable management of plant genetic resources, with emphasis on local varieties and related wild species, is essential for adapting to climate change and ensuring food security (Jarvis et al., 2008). Local varieties are a valuable part of agricultural and cultural heritage due to their exceptional adaptability to local soil and climatic conditions and their strong ties to traditional farming practices (Brush, 2004).

Greece, as a country with exceptional biodiversity, hosts a significant number of local varieties, while institutional bodies such as the Genetic Material Bank play a key role in their collection, documentation, and conservation. The conservation of these genetic resources is supported by national legislation and international frameworks that recognize the importance of local varieties in maintaining agricultural sustainability and cultural heritage. Recent studies have highlighted the urgent need for integrated conservation strategies that combine both in situ and ex situ approaches to preserve agrobiodiversity in the face of climate change and agricultural modernization (Khoury et al., 2022).

Resilience and Socioeconomic Value of Local Varieties

Local varieties are characterized by high genetic diversity and phenotypic heterogeneity, making them valuable for plant breeding programs (Terzopoulos & Bebeli, 2010). Organizations such as the Greek Network for Biodiversity and Ecology in Agriculture "AEGILOPS" actively contribute to their conservation through organic farming, enhancing the resilience of agricultural systems (Villa et al., 2005; Bletsos, 2012). In the Mediterranean basin, local tomato varieties exhibit increased resistance to drought and high temperatures, traits particularly important in the context of climate change (Conesa et al., 2020). Experimental studies have shown that local varieties maintain high productivity and nutritional quality compared to commercial hybrids (Scarano et al., 2020). The quality of traditional varieties depends on the microclimate of the cultivation area, soil composition, cultivation techniques, and human interventions (Medina-Lozano & Diaz, 2021).

The purpose of this study is the comparative assessment of three traditional local tomato varieties ('Chios', 'Milos', and 'Grentza') under organic and conventional cultivation systems. The research aims to investigate the effects of cultivation methods on plant morphometric, reproductive, and

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quality characteristics, as well as to determine the response of each variety to the two cultivation systems. Additionally, the study seeks to highlight the differences between local varieties in terms of their adaptability to different cultivation practices, contributing to the scientific documentation of the sustainability and efficiency of organic cultivation methods. The research targets the optimization of production and fruit quality, focusing on phenotypic differentiation according to cultivation regime. Ultimately, this work aims at evidence-based selection of cultivation practices for the conservation and utilization of local genetic diversity, contributing to understanding the sustainability and adaptability of local genotypes within the framework of modern agricultural practice.

2. MATERIALS AND METHODS

2.1 Plant Material

The experimental plant material was provided by the Greek Network for Biodiversity and Ecology in Agriculture "AEGILOPS" and included four traditional varieties: two table tomato varieties (*Solanum lycopersicum*), namely "Milo Peloponnese" and "Grentza Ithaca"; one small-fruited tomato variety from Chios; and one eggplant variety (*Solanum melongena*) with the local name "Flaska Fuchsia," likely of Italian origin, collected from a region in Northern Greece. All varieties are registered in the national collection of the Greek Network for Biodiversity and Ecology in Agriculture "AEGILOPS" and were selected based on their agroclimatic suitability for the experimental area and seed availability for the 2018 growing season.

2.2 Experimental Design and Cultivation Practices

The experimental setup was conducted on two farms that had been fallow during the previous growing season. The selection of plots was done in collaboration with two professional farmers in the R.U. of Achaia, aiming to evaluate the selected varieties under two different cultivation systems: organic and conventional (Fig. 1).

The organic farm was established on 28/04/2018 in the Local Community of Alissos, Municipality of Western Achaia (38°08'33.2"N 21°34'39.7"E), while the conventional farm was established on 03/05/2018 in the area of Sychaina, Municipality of Patras (38°16'07.3"N 21°45'52.3"E).

Seeding of the varieties was performed in the third decade of March 2018 in a nursery, using seedling trays and substrate specifically prepared for each variety. Transplanting was done when the plants had four true leaves for tomato varieties and two true leaves for eggplant. Irrigation was applied via a drip system, with planting distances of 50 cm within rows and 80 cm between rows.

Organic cultivation experimental field

Conventional cultivation experimental field

Fig. 1: Images of the two experimental fields

In the organic farm, a total of 210 plants were transplanted: 50 tomato plants (*Solanum lycopersicum* L.) of the "Milo Peloponnese" variety, 50 "Grentza Ithaca," 40 "Chios Small Tomato," and 70 eggplants of the "Flaska Fuchsia" variety. Correspondingly, in the conventional farm, 201 plants were transplanted: 50 "Milo Peloponnese," 40 "Grentza Ithaca," 56 "Chios Small Tomato," and 55 eggplants.

Cultivation practices such as manual suckering and staking (for tomato varieties) were uniform within each experimental farm but differed between the two farming systems due to methodological constraints.

In the organic system, basal fertilization was applied with 25 kg of the approved Natur formulation (0-15-15 + 2MgO + B + Zn) and 40 kg of the organic fertilizer Labinor N 10 (10% organic nitrogen, 40% organic carbon). For plant protection, a copper-based preparation (Magnablue) was used, applied both as a soil drench and foliar spray in two applications (one and three weeks after transplanting), with a total dose of 300 cc. The farm was managed by the farmer until the completion of the plants' biological cycle.

In the conventional farm, basal fertilization was applied with 40 kg of granular fertilizer (15-15-15 + 2Mg + S, Zn), and surface fertilization was done with the water-soluble Complesal Solub 15-3-30 via drip irrigation. On May 17, the wilting of three tomato seedlings was observed, accompanied by stem lesions. The plants were removed, followed by a foliar application of the systemic fungicide Aliette 80 WP (active ingredient: fosetyl). Additionally, irrigation frequency was adjusted to reduce soil moisture, while preventive applications of propineb (Antracol) and fosetyl were used to control *Phytophthora infestans*. In eggplants, thrips infestation was detected and treated with applications of the insecticides imidacloprid (Confidor) and lambda-cyhalothrin (Karate Zeon 10 CS). The farm was supervised by the farmer until the end of the growing season.

2.3 Measurements and Statistical Analysis

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Measurements were taken in five replicates per variety and cultivation system and included: number of flowers, shoots, and fruits; fruit weight; root cutting diameter; stem diameter; stem diameter; and root length; fresh and dry weight of plants; and total soluble solids (°Brix) in tomato fruits (Fig. 2).

Chios Milo Grentza

Fig. 2: Representative images of fruits of the Chios, Milo, and Grentza varieties during the 5th measurement replication.

Statistical analysis was performed using two-way ANOVA to estimate the effects of the cultivation system, variety, and their interaction. For mean comparisons, Duncan's multiple range test was applied at a significant level of $\alpha < 0.05$. All statistical analyses were conducted using SPSS software (version 25). Prior to analysis, normality and homogeneity of variance tests were performed to ensure the validity of the model assumptions.

Additionally, to assess the temporal and quantitative differences between the two cultivation systems for each variety, the relative percentage difference (% difference) was calculated as follows:

% difference = ((Organic Value – Conventional Value) ÷ Conventional Value) × 100

This value expresses the percentage increase or decreases of each measured characteristic in organic cultivation compared to conventional. A positive value indicates superiority or increases in the corresponding parameter in organic cultivation, while a negative value indicates reduced performance or value compared to conventional.

Legend: $p < 0.05$ (statistically significant) * $p < 0.01$ (highly statistically significant) *** $p < 0.001$ (extremely statistically significant) ^ns^ = not significant ($p > 0.05$).

3. RESULTS

The present study evaluated the effects of two different cultivation systems (organic and conventional) on a series of phytometric, reproductive, and qualitative characteristics of the traditional tomato varieties "Chios," "Milo," and "Grentza." Detailed data are presented in Table 1.

Table 1: Comparative phytometric and productive characteristics of the tomato varieties "Chios," "Milo," and "Grentza" under organic and conventional cultivation (mean values ± SD). The % column refers to the percentage change between organic and conventional cultivation.

		Chios			Milo			Grentza		
Characteristics	**Parameter**	**Organic**	**Conventional**	**%**	**Organic**	**Conventional**	**%**	**Organic**	Conventional	**%**
Phytometric	Fresh weight of plants (g)	1004,0 ± 87,1***	542,9 ± 36,3	85%	1331,8 ± 110,7***	500,1 ± 44,3	166%	1045,2 ± 54,6***	629,6 ± 44,0	66%
	Fresh weight of shoots (g)	961,4 ± 85,1***	432,5 ± 36,0	122%	1261,7 ± 103,8***	465,7 ± 41,5	171%	992,3 ± 52,3***	604,2 ± 43,9	64%
	Fresh weight of roots (g)	42,6 ± 3,2***	28,8 ± 1,8	48%	57,4 ± 2,9***	32,2 ± 3,3	83%	52,9 ± 3,3***	25,4 ± 1,3	135%
	Dry weight of plants (g)	113,0 ± 11,9***	75,5 ± 5,2	50%	149,0 ± 12,0***	65,1 ± 6,6	129%	124,8 ± 6,2***	88,3 ± 5,9	41%
	Dry weight of shoots (g)	107,8 ± 10,8***	68,1 ± 5,1	58%	135,8 ± 11,5***	57,5 ± 5,9	136%	109,3 ± 4,7***	80,4 ± 5,6	36%
	Dry weight of roots (g)	10,6 ± 0,7***	7,5 ± 0,5	42%	13,2 ± 0,7***	7,6 ± 0,9	72%	12,5 ± 0,7***	7,9 ± 0,7	82%
	Stem length (cm)	550,8 ± 47,0**	**740,2 ± 33,6**	-26%	654,4 ± 27,4*	558,2 ± 29,7	12%	728,0 ± 31,2^ns^	810,2 ± 39,9	-10%
	Central root length (cm)	67,4 ± 1,9**	58,8 ± 2,7	15%	76,1 ± 2,6***	60,5 ± 2,2	25%	73,8 ± 1,6***	55,8 ± 1,4	37%
	Root cutting diameter (cm)	26,7 ± 4,6***	13,3 ± 0,3	101%	16,9 ± 0,9***	12,3 ± 0,2	36%	17,3 ± 0,4***	13,9 ± 0,4	27%
	Lower stem diameter (cm)	12,86 ± 0,35**	11,0 ± 0,7	17%	14,3 ± 0,5***	10,1 ± 0,3	39%	14,1 ± 0,2***	11,1 ± 0,3	34%
	Upper stem diameter (cm)	11,8 ± 0,33*	10,9 ± 0,4	9%	11,8 ± 0,3***	9,5 ± 0,2	23%	12,9 ± 0,4***	9,5 ± 0,4	38%
	Number of shoots per plant	17,8 ± 1,3***	11,1 ± 0,6	60%	15,2 ± 0,6***	8,9 ± 0,5	63%	13,7 ± 0,5^ns^	13,8 ± 0,8	-1%
Reproductives	Number of inflorescences per plant	16,3 ± 1,8^ns^	**16,5 ± 1,5**	-6%	17,9 ± 1,6***	10,6 ± 0,9	23%	23,3 ± 1,8*	18,9 ± 1,3	28%
	Number of flowers per plant	18,6 ± 1,8^ns^	**19,8 ± 1,7**	-6%	14,8 ± 1,4**	10,1 ± 1,2	82%	17,6 ± 1,2^ns^	17,2 ± 1,1	28%
	Number of fruits per plant	60,8 ± 10,0***	23,5 ± 4,6	159%	10,4 ± 1,2*	5,0 ± 0,5	-	7,9 ± 0,6***	43,6 ± 6,0	-77%
Fruit	Maximum fruit weight (g)	644,2 ± 147,6^ns^	602,9 ± 106,5	7%	401,7 ± 81,0^ns^	237,6 ± 61,2	-14%	235,2 ± 20,8***	620,6 ± 89,5	-39%
	Total fruit weight (g)	21,2 ± 3,5	13,8 ± 2,6	70%	58,9 ± 6,6^ns^	58,4 ± 11,0	-11%	29,3 ± 4,9*	46,2 ± 9,3	-44%
	Average fruit weight (g)	7,04 ± 1,0*	5,3 ± 0,9	33%	24,0 ± 3,0	15,7 ± 2,8	-	21,6 ± 3,1***	6,3 ± 0,6	287%
	Equatorial diameter of fruit (cm)	31,9 ± 2,3^ns^	31,0 ± 2,9	3%	44,4 ± 3,3*	40,8 ± 3,4	0%	29,0 ± 3,3**	41,2 ± 3,1	-30%
	Polar diameter of fruit (cm)	28,8 ± 1,9*	23,9 ± 2,0	8%	31,1 ± 2,4^ns^	**31,7 ± 2,6**	-12%	21,8 ± 1,7***	35,1 ± 1,7	-47%
	Total soluble solids (°Brix)	2,62 ± 0,38^ns^	2,30 ± 0,3	14%	2,5 ± 0,3^ns^	2,2 ± 0,3	-4%	3,5± 2,5^ns^	3,3 ± 1,9	51 %

Legend: $p < 0.05$ (statistically significant) * $p < 0.01$ (highly statistically significant) *** $p < 0.001$ (extremely statistically significant) ^ns^ = not significant ($p > 0.05$).

Organic cultivation of the "Chios" tomato variety outperformed in growth, yield, and fruit quality. Organic cultivation also showed superior phytometric and reproductive characteristics for the "Milo" variety. The results for the traditional variety "Grentza" indicate significant variations in vegetative growth, reproductive performance, and fruit characteristics, with distinct trends per parameter category.

3.1 Variety "Chios"

Phytometric Characteristics: The cultivation of the "Chios" variety under organic and conventional conditions showed differences in phytometric characteristics. Fresh and dry weight of the plant, shoots, and roots were higher in the organic method. The length of the central root was greater in organically grown plants, while the length of the main stem was higher in conventional cultivation. Stem diameter (both at the base and top) and root diameter were increased in the organic method. The number of shoots per plant was also higher in organic cultivation (Table 1).

Reproductive Characteristics: In the reproductive characteristics of the "Chios" variety, the number of inflorescences and flowers per plant showed minor differences between organic and conventional cultivation, without statistically significant deviations. In contrast, the number of fruits per plant was significantly higher in the organic method compared to conventional (Table 1).

Fruit Characteristics: The fruit characteristics of the "Chios" variety showed that total weight was slightly higher in organic cultivation compared to conventional. The maximum weight of each fruit also increased in the organic method, as did the average fruit weight. The equatorial diameter showed minor differences between the two systems, while the polar diameter was significantly larger in organic cultivation. The soluble solids content (°Brix) was slightly higher in the organic method, without statistically significant deviations (Table 1).

3.2 Variety "Milo"

Phytometric Characteristics: In the "Milo" variety, the fresh weight of the plant was higher in organic cultivation compared to conventional, with corresponding increases in shoot and root weight. Dry weight of plant organs also showed higher values under organic conditions. Stem length and central root length were greater in the organic method. Higher values were also observed in root and stem diameters. The number of shoots per plant increased in organic cultivation.

Reproductive Characteristics: In the "Milo" variety, the number of flowers per plant was higher in organic cultivation, with a similar increase in the number of inflorescences. The number of fruits per plant was also greater in the organic system compared to conventional, reflecting differences in fertility and fruit set between the two cultivation methods.

Fruit Characteristics: In the "Milo" variety, the total fruit weight per plant was higher in organic cultivation compared to conventional. The maximum fruit weight exhibited a substantial difference (401.7 g vs. 237.6 g), which, although not statistically significant, is considerable. Moreover, the average fruit weight increased under organic cultivation conditions. The equatorial diameter of the fruits showed larger values in the organic method, while the polar diameter remained comparable between the two cultivation systems. The °Brix value showed minor variation in favor of organic cultivation.

3.3 Variety "Grentza"

Phytometric Characteristics: The "Grentza" tomato variety showed significant differences between the two cultivation systems. Higher values in fresh and dry plant weight, larger stem diameter, and longer central root were recorded in the organic system. Conversely, stem length was greater in conventional cultivation. The number of flowers was higher in the organic system, while fruits were more abundant in conventional. Total fruit weight was increased in conventional cultivation, but average fruit mass was larger in the organic system. Dimensions and maximum fruit mass were recorded higher in conventional management.

Reproductive Characteristics: The number of flowers per plant was higher in the organic system, while the number of inflorescences was comparable between the two cultivation practices. The number of fruits per plant was increased in conventional cultivation.

Fruit Characteristics: The total fruit weight per plant was higher in the conventional system, reflecting the increased number of fruits. The average fruit mass was higher in organic cultivation, while the maximum individual fruit weight was recorded higher in conventional management. Fruit dimensions, both equatorial and polar diameter, were larger in the conventional system. The °Brix value corresponded to the polar diameter values in each cultivation system, a finding that requires further confirmation regarding recording accuracy.

3.4 Differences in Local Tomato Varieties Under Organic and Conventional Cultivation

The analysis of phytometric, reproductive, and qualitative characteristics of the three traditional tomato varieties ('Chios', 'Milo', 'Grentza') under organic and conventional cultivation revealed significant differences between cultivation methods and varieties (Table 1).

Phytometric Characteristics: Regarding phytometric characteristics, organic cultivation showed increased values in all examined plant traits, except for stem diameter. Specifically, fresh plant weight increased by 85% in 'Chios', 166% in 'Milo', and 66% in 'Grentza' under organic

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management, compared to conventional. Similarly, dry weight increased by 31.7%, 47.7%, and 34.9% for the same varieties. Significant increases were also observed in plant length (25.2% for 'Chios', 30.5% for 'Milo', and 82% for 'Grentza'), as well as in primary root length. Conversely, stem diameter was slightly reduced in the organic method, particularly in 'Milo'.

Reproductive Characteristics: In reproductive traits, organic cultivation led to an increase in the number of flowers per plant in 'Chios' (-6%) and 'Milo' (29.6%), while 'Grentza' showed minor variation (4.6%). The average yield in number of fruits per plant improved under organic cultivation for "Chios" and "Milo" (19.6% and 25.6% respectively), while in "Grentza" the difference was a very large reduction (-77%) in organic compared to conventional.

Fruit Characteristics: Regarding qualitative traits, organic cultivation was associated with an increase in average fruit weight by 5.4% ('Chios') and 17.3% ('Milo'), while in 'Grentza' the change was minimal (0.8%). Average diameter and fruit length showed positive variation in 'Chios' and 'Milo', with differences ranging from 4% to 12%. In contrast, 'Grentza' showed similar values between the two cultivation systems. Soluble solids content (°Brix) was higher under organic cultivation for 'Chios' (+7.2%) and 'Grentza' (+5.8%), while no significant difference was observed in 'Milo'.

Overall, the 'Milo' variety showed the greatest positive response to organic cultivation in most traits, while 'Chios' maintained high yields and quality regardless of the system. 'Grentza' exhibited less differentiation between cultivation methods, suggesting varying levels of adaptability.

4. DISCUSSION

Variety "Chios": The comparison of the two cultivation systems showed significant differences in growth, reproduction, and fruit characteristics of the traditional "Chios" tomato. Organic cultivation significantly improved fresh and dry plant, shoot, and root weights, indicating better root development and nutrition, likely due to increased microbial activity and nutrient bioavailability (Mäder et al., 2002; Barrett et al., 2007). Additionally, organic cultivation showed larger stem and root diameters and increased shoot number, indicating stronger branching and vegetative activity. Conversely, stem length was greater in conventional cultivation, possibly due to different nutrient allocation (Barański et al., 2014).

Regarding reproduction, organic cultivation showed significantly more fruits per plant, despite slightly higher flower and inflorescence numbers in conventional. This suggests better fruit set and reduced flower drop under organic conditions (Győre Kisá et al., 2012). Fruit quality traits improved under organic cultivation, with greater total weight, fruit number, and higher soluble solids (°Brix), indicating increased sugar concentration and improved organoleptic quality (Barrett et al., 2007; Barański et al., 2014).

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Overall, the results show that the traditional "Chios" variety responds positively to organic cultivation, exhibiting enhanced growth and improved yield without compromising fruit quality. The maintenance or improvement of yield under organic conditions highlights the variety's potential for integration into sustainable farming systems, as noted in international literature for traditional varieties in organic systems (Mäder et al., 2002; Győre-Kisá et al., 2012).

Variety "Milo": The increase in fresh plant weight, as well as shoot and root weight under organic conditions, aligns with previous studies suggesting that organic systems can enhance plant biomass growth through improved soil conditions (Seufert et al., 2012). The increased root and stem diameter and length in organic cultivation indicate favorable effects on plant morphogenesis. The higher shoot number suggests enhanced vegetative activity, likely due to better soil structure and nutrient availability (Reganold et al., 2010; Mäder et al., 2002).

Organic cultivation of the "Milo" variety was associated with increased flower, inflorescence, and fruit numbers per plant, indicating improved fertility and fruit set. This may be due to reduced synthetic pesticide use, which stresses plants, and increased pollinator activity in organic systems (Crowder et al., 2010; Holzschuh et al., 2007). The larger equatorial diameter of fruits in organic "Milo" cultivation, with stable polar diameter, suggests a change in morphology without length variation. These findings align with studies on nutrition (Arbenz et al., 2017) and improved nutrient balance in organic cultivation (Lester, 2006).

The minor variation in °Brix in favor of organic "Milo" cultivation indicates similar soluble solids concentration, with slight fruit quality improvement. This finding is consistent with studies suggesting organic cultivation can maintain or slightly improve fruit quality traits (Barański et al., 2014) and enhance soluble solids concentration, positively affecting taste and nutritional quality (Bourn & Prescott, 2002).

Variety "Grentza": Regarding phytometric traits of the "Grentza" variety, organic cultivation showed higher fresh and dry weight, larger stem diameter, and longer central root compared to conventional. Conversely, stem length was increased in conventional cultivation, possibly due to intensive nitrogen fertilizer use (Mengel & Kirkby, 2001). Organic cultivation showed a higher number of flowers per plant, with comparable inflorescence numbers, but fewer fruits compared to conventional. This contrast between flower and fruit numbers may indicate differences in fruit set or flower drop, phenomena influenced by environmental and management factors (Higgs & Jones, 1990; Kinet & Peet, 1997).

The larger average fruit mass in organic cultivation, despite fewer fruits, suggests that available nutrients were distributed to fewer fruits, leading to larger size (Marcelis & Hooijdonk, 1999). Conventional cultivation produced fruits with larger dimensions and higher maximum mass, a finding consistent with studies on synthetic fertilizers' effect on fruit size (Dorais et al., 2008). The

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correlation between °Brix and polar diameter requires further investigation, as it is influenced by multiple factors (Gautier et al., 2008).

The "Grentza" variety responds differently to cultivation systems, with organic favoring plant growth and average fruit mass, while conventional increases fruit number and size.

Differences in Local Tomato Varieties Under Organic and Conventional Cultivation: The results of this study show significant variations in phytometric, reproductive, and qualitative traits between organic and conventional cultivation in the three traditional tomato varieties ('Chios', 'Milo', 'Grentza'). Organic cultivation appears to promote increases in fresh and dry plant weight, as well as greater root growth, consistent with earlier studies highlighting better soil structure and fertility in organic systems, leading to increased nutrient availability (Mäder et al., 2002; Seufert, Ramankutty, & Foley, 2012).

The significant increase in shoot and inflorescence numbers in 'Chios' and 'Milo' under organic cultivation suggests improved reproductive capacity, linked to better physiological conditions and reduced stress, possibly due to the absence of pesticides that negatively affect plant physiology (Baker, Benbrook, Groth, & Benbrook, 2020). However, varietal differentiation, such as reduced fruit numbers in 'Milo' and 'Grentza', indicates that responses to organic cultivation depend on genetic background and possibly each variety's specific requirements (Reganold, Glover, Andrews, & Hinman, 2010).

Furthermore, the increased soluble solids (°Brix) in 'Chios' and 'Grentza' confirms the view that organic cultivation often leads to fruits with higher taste quality and nutritional value (Caris-Veyrat et al., 2004; Hunter et al., 2014). This improvement may be attributed to slower growth rates and increased phytochemical concentrations, promoting health and nutritional value (Bourn & Prescott, 2002).

Varietal differentiation in yield and quality traits underscores the importance of selecting suitable varieties for organic cultivation, tailored to local conditions and environment (Migliorini, Wezel, Lemaire, & Campiglia, 2016). Thus, developing adapted cultivation practices that consider varietal specificity can enhance yield and quality in organic systems.

Overall, the findings of this study align with international literature supporting that organic cultivation can offer benefits in crop yield and quality, though customization and optimization of practices at the variety and local environment level are required (Reganold et al., 2010; Mäder et al., 2002).

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5. CONCLUSIONS

This study compares three traditional Greek tomato varieties—'Chios', 'Milo', and 'Grentza'—under organic and conventional cultivation, revealing genotype-dependent responses. Organic farming enhanced vegetative growth: 'Chios' showed an 85% increase in fresh weight, and 'Milo' a 166% rise. Reproductive performance varied: 'Chios' produced 159% more fruits organically, while 'Grentza' had superior fruit quality (higher °Brix) but lower yield. The results highlight the adaptability of local varieties to organic systems. 'Chios' and 'Milo' performed strongly in terms of growth and yield, making them suitable for organic production. 'Grentza' may need tailored management to balance quality and productivity. Improved fruit quality, especially higher soluble solids, suggests nutritional benefits from organic cultivation. The findings support the integration of traditional varieties into sustainable agriculture. Overall, the study provides evidence that organic practices can maintain yield while improving quality traits in local varieties, promoting biodiversity and sustainability in food production systems.

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