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TRENDS IN GLOBAL TOMATO PRODUCTION AND PRIORITIES FOR THE RECOVERY OF THE DOMESTIC INDUSTRY UNDER CONDITIONS OF GLOBAL INSTABILITY

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The article provides a comprehensive analysis of the current state and global development trends in tomato production as one of the major vegetable crops of the world agricultural sector. The significance of the industry in ensuring food security is substantiated, and the main directions of its intensification under conditions of climate change, technological progress, and increasing competition in the global market are considered. Particular attention is paid to the study of the dynamics of cultivated areas, production volumes, and tomato yields worldwide during the period 2000–2024, which made it possible to identify stable trends toward the growth of global production and its concentration in leading producing countries.

It was established that the dominant positions in global tomato production are occupied by Asian countries, primarily China and India, which account for the largest share of total production. At the same time, African countries demonstrate the most dynamic expansion of cultivation areas, whereas Europe and the Americas show stabilization or reduction in planted areas against the background of increasing production intensification. Regional peculiarities of yield formation were analyzed, revealing that the highest productivity levels are achieved in countries with advanced protected cultivation technologies and a high level of resource provision.

The current state of the tomato production sector in Ukraine was examined separately. A significant reduction in cultivated areas and destabilization of production cycles caused by military actions, destruction of infrastructure, and disruption of technological processes were identified. At the same time, a positive long-term trend in yield growth was established, indicating the existence of substantial potential for further sector development under the condition of implementing modern agricultural technologies.

It was substantiated that improving the efficiency of tomato production in Ukraine requires the adaptation of global experience, particularly through the introduction of innovative cultivation technologies, the development of greenhouse production, optimization of agronomic practices, and enhancement of resource provision. The obtained results may be used to formulate strategic directions for vegetable production development and to increase the competitiveness of domestic products in the global market.

Key words: *tomato, agricultural technologies, plant density, intensification, cultivated areas, yield, production volumes, global market, greenhouse production, food security.*

Сидякіна О.В., Іванів М.О. Тенденції світового виробництва томатів та пріоритети відновлення вітчизняної галузі в умовах глобальної нестабільності

У статті здійснено комплексний аналіз сучасного стану та глобальних тенденцій розвитку виробництва томатів як однієї із основних овочевих культур світового аграрного сектору. Обґрунтовано значення галузі у забезпеченні продовольчої безпеки, а також

розглянуто основні напрями її інтенсифікації в умовах кліматичних змін, технологічного прогресу та зростання конкуренції на світовому ринку. Особливу увагу приділено дослідженню динаміки посівних площ, обсягів виробництва та рівня врожайності томатів у світі за період 2000–2024 рр., що дозволило виявити стійкі тенденції до зростання глобального виробництва та концентрації його у провідних країнах.

Встановлено, що домінуючі позиції у світовому виробництві томатів займають країни Азії, насамперед Китай та Індія, які забезпечують основну частку валового збору культури. Водночас у країнах Африки спостерігається найбільш динамічне збільшення площ вирощування, а в Європі та Америці відмічається стабілізація або скорочення площ посівів на фоні підвищення рівня інтенсифікації виробництва. Проаналізовано регіональні особливості формування врожайності, де найвищі показники досягаються у країнах із розвиненими технологіями захищеного ґрунту та високим рівнем ресурсного забезпечення.

Окремо розглянуто сучасний стан галузі виробництва томатів в Україні. Виявлено тенденцію до суттєвого скорочення посівних площ та дестабілізацію виробничих циклів, зумовлених впливом воєнних дій, руйнуванням інфраструктури та порушенням технологічних процесів. Водночас встановлено позитивну динаміку врожайності у довгостроковому періоді, що свідчить про наявність потенціалу для подальшого розвитку галузі за умови впровадження сучасних агротехнологій.

Обґрунтовано, що підвищення ефективності виробництва томатів в Україні потребує адаптації світового досвіду, зокрема впровадження інноваційних технологій вирощування, розвитку тепличного господарства, оптимізації агротехнічних заходів та підвищення рівня ресурсного забезпечення. Отримані результати можуть бути використані для формування стратегічних напрямів розвитку овочівництва та підвищення конкурентоспроможності вітчизняної продукції на світовому ринку.

Ключові слова: *томат, агротехнології, густота рослин, інтенсифікація, посівні площі, урожайність, обсяги виробництва, світовий ринок, тепличне господарство, продовольча безпека.*

Problem statement. Tomato production occupies an important place in the structure of global vegetable farming and plays a significant role in ensuring food security. Under current conditions, a stable trend toward industry intensification, implementation of innovative technologies, and increasing requirements for product quality and environmental sustainability is being observed. Leading countries actively apply modern cultivation technologies, including protected cultivation systems, digital solutions, and advanced breeding developments, which contribute to higher yields and ensure production stability under conditions of climate change [1].

For Ukraine, the generalization of global experience and a systematic analysis of tomato production dynamics are of considerable strategic importance for the objective assessment of the agricultural market environment and identification of the main trends in its development. The integration of such analytical results with the implementation of modern agricultural technologies will contribute to improving the efficiency of natural and climatic resource utilization, identifying internal reserves for sector growth, and ensuring sustainable tomato production under conditions of intensifying global competition.

Analysis of recent research and publications. Tomato is one of the leading vegetable crops cultivated in both open-field and protected-ground conditions, characterized by high adaptability to growing conditions and a significant response to technological factors. Contemporary studies focus considerable attention on the optimization of agronomic practices, particularly plant density and planting schemes, which directly influence yield formation and product quality.

Plant density significantly affects the photosynthetic activity of the agrocenosis, the efficiency of light energy utilization, and plant productivity. Increasing plant density contributes to higher overall yields due to more efficient light interception by plants; however, it is accompanied by a reduction in fruit weight and intensified competition among plants for water, nutrients, and light [2].

The optimal plant density and planting arrangement under greenhouse conditions (approximately 2.5–4.0 plants/m^2 depending on the hybrid and growing conditions) ensure efficient utilization of area and light, while contributing to a high level of marketable yield. At the same time, excessive crop density leads to intensified competition among plants, deterioration of the light regime and microclimate within the agrocenosis, which may increase humidity levels and promote disease development [3].

Under open-field conditions, the optimization of row spacing and in-row plant distance is of considerable importance. Rational planting schemes (particularly within the range of 70 × 30 cm to 90 × 40 cm, depending on the biological characteristics of the cultivar or hybrid) ensure efficient utilization of the nutritional area and contribute to the realization of the crop productivity potential. Plant density may vary within a wide range (25–45 thousand plants/ha), depending on the genotype and soil-climatic growing conditions [4].

Some studies indicate that indeterminate tomato varieties require a lower planting density compared to determinate varieties, which is attributed to their more intensive vegetative growth and the necessity for bush formation. The optimization of spatial arrangement, in conjunction with agronomic practices for bush formation (such as pruning and regulating the number of stems), contributes to a more effective utilization of solar radiation, improves the phytosanitary condition of the crops, and enhances fruit quality [5].

In addition to plant density, the method of transplanting seedlings is also an important technological element. The use of band planting schemes contributes to more efficient utilization of the nutritional area, improvement of crop light conditions, and, under optimal conditions, provides higher yields compared with traditional row planting systems [6].

It has also been established that the optimal density of tomato plants largely depends on the level of mineral nutrition and water supply. Under drip irrigation and balanced mineral fertilization, plants more effectively realize their productivity potential in dense stands due to the stable supply of moisture and nutrients. Under such conditions, increased plant density is not accompanied by a significant reduction in fruit weight and, in some cases, contributes to higher overall crop productivity [7].

At the same time, it should be noted that tomato productivity formation depends not only on plant density and transplanting schemes, but also on a complex of other agrotechnological factors. The growth, development, and yield formation of the crop are substantially influenced by varietal characteristics and the biological type of plants [8], fertilization systems [9], irrigation regimes [10], integrated plant protection measures [11], soil and climatic growing conditions, as well as a number of other factors [12, 13]. Particular importance is attached to the adaptation of technological elements to climate change, especially to increasing temperatures, moisture deficits, and the growing frequency of stress factors that directly affect the stability of tomato production [14].

Alongside the improvement of technological practices, an important direction of scientific research is the assessment of the current state of tomato production. The analysis of the dynamics of cultivated areas, yields, and production volumes makes it possible to identify the main trends in sector development, the level of realization of the crop potential, and the efficiency of cultivation technologies under specific soil-climatic and economic conditions. Therefore, the study of the current state of tomato production is a necessary prerequisite for substantiating prospects for increasing crop productivity and improving cultivation technologies.

Materials and methods. The aim of the study was to conduct a comprehensive analysis of global trends in the functioning of the tomato market, identify Ukraine's position within the structure of global production, and determine the specific features of sectoral development in leading producing countries. To achieve the stated objective and ensure the representativeness of the obtained results, a complex of general scientific and specialized research methods was applied, including systemic-analytical, comparative, graphical visualization, and theoretical generalization methods. The information base of the study consisted of statistical data from the FAOSTAT system (Food and Agriculture Organization of the United Nations) [15], the results of fundamental and applied research conducted by domestic and foreign scientists, as well as the authors' own generalizations and analytical calculations.

Presentation of the main research material. Analysis of the dynamics of global tomato cultivation areas indicates a stable upward trend. During 2000–2024, cultivated areas increased from 3.85 to 5.12 million ha, indicating the growing importance of this crop in global vegetable production (Table 1). The main increase was ensured by Asian countries, whose share remains dominant (over 50% of global cultivated areas), as well as African countries, where the most dynamic expansion of cultivated areas was observed (from 0.74 to 1.67 million ha). At the same time, European and American countries demonstrated a tendency toward reduction or stabilization of cultivated areas, which is associated with production intensification and increasing yields.

Table 1

Global trends in tomato area harvested by region

Year	Regions of the world										World crop area, million hectares
	Africa		America		Asia		Europe		Oceania		
	million hectares	% of world crop area	million hectares	% of world crop area	million hectares	% of world crop area	million hectares	% of world crop area	million hectares	% of world crop area	
2000	0.740	19.2	0.518	13.4	1.900	49.3	0.686	17.8	0.010	0.3	3.853
2010	1.040	23.2	0.473	10.6	2.400	53.6	0.555	12.4	0.009	0.2	4.477
2015	1.353	27.5	0.458	9.3	2.591	52.7	0.505	10.3	0.007	0.1	4.913
2020	1.763	33.9	0.372	7.1	2.645	50.8	0.420	8.1	0.005	0.1	5.205
2022	1.826	34.9	0.385	7.4	2.642	50.5	0.375	7.2	0.006	0.1	5.235
2024	1.672	32.6	0.397	7.8	2.647	51.7	0.399	7.8	0.006	0.1	5.121

Source: FAOSTAT, 2026

A significant concentration of production is observed in the leading countries – China, India, Nigeria, Turkey, Egypt, the United States, and Italy – which together account for more than 65% of the global tomato cultivation area (Table 2). China maintains its leading position with a gradual increase in cultivated areas exceeding 1.0 million ha, whereas the dynamics in other countries are more variable.

In contrast to global trends, Ukraine has experienced a reduction in tomato cultivation areas: from 116.5 thousand ha in 2000 to 56.2 thousand ha in 2024 (Fig. 1). A particularly sharp decline occurred after 2021, which was directly caused by the full-scale military invasion, temporary occupation of the main production regions in southern Ukraine, and destruction of irrigation systems. Such structural distortions of the sector

under the influence of external security-related factors require a revision of vegetable production development strategies, a shift in emphasis toward production intensification in relatively safe regions, and the implementation of energy-efficient protected cultivation technologies.

Table 2

Trends in tomato area harvested across leading producing countries, million hectares

Year	Leading tomato producing countries								% of world crop area
	China	Egypt	India	Italy	Nigeria	Turkey	USA	Seven countries together	
2000	0.674	0.195	0.460	0.137	0.210	0.208	0.169	2.053	53.3
2010	0.952	0.216	0.634	0.119	0.273	0.179	0.159	2.532	56.6
2015	1.030	0.197	0.767	0.107	0.558	0.187	0.163	3.009	61.2
2020	1.107	0.160	0.818	0.100	0.938	0.174	0.110	3.407	65.5
2022	1.096	0.158	0.843	0.098	1.018	0.159	0.110	3.482	66.5
2024	1.095	0.175	0.854	0.103	0.822	0.182	0.106	3.337	65.2

Source: FAOSTAT, 2026

Significant fluctuations in tomato cultivation areas in Ukraine caused corresponding changes in production volumes. The lowest production level was observed in 2000 (1.127 million t), while the maximum was recorded in 2021 (2.445 million t). The reduction of cultivated areas to 51.5 thousand ha in 2022 resulted in a decrease in gross production to 1.257 million t.

Analysis of the dynamics of global tomato production indicates a stable upward trend in gross output. During 2000–2024, production volumes increased from 109.4 to 188.5 million t, or nearly 1.7-fold, due both to the expansion of cultivated areas and to increasing yields. Since 2021, certain variability in indicators has been observed, including a decline in 2022 to 181.3 million t, followed by recovery in 2023–2024.

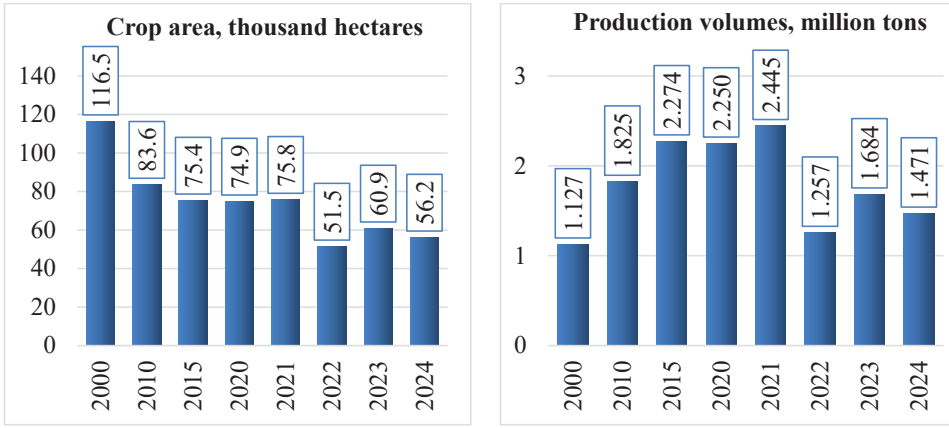

Fig. 1. Trends in tomato crop area and production volume in Ukraine

Source: FAOSTAT, 2026

From a regional perspective, Asia occupies the dominant position, accounting for more than 60% of global production. During the studied period, production in this region more than doubled – from 51.4 to 113.9 million t – primarily due to the development of the sector in China and India. African countries are characterized by dynamic growth in production volumes, from 13.4 to 26.4 million t, indicating intensive development of the industry in this region. In the Americas, production remains relatively stable with minor fluctuations (within the range of 23.7–28.4 million t). Europe demonstrates high stability in tomato production volumes (20.6–24.5 million t), while the lowest gross production is traditionally characteristic of Oceania (less than 0.5 million t).

Analysis of tomato production volumes in the leading countries of the world indicates a stable trend toward the growth of global tomato production and increasing concentration of production in the largest producing countries. During 2000–2024, the total gross tomato production in the leading countries increased from 66.8 to 125.5 million t, or nearly 1.9-fold (Table 3). The share of these countries in global production increased from 61.1% to 66.6% over the studied period.

China is the undisputed global leader in tomato production. In 2024, the country's gross tomato production amounted to 61.7 million t, which was almost 2.8 times higher than the 2000 level (22.3 million t). The rapid expansion of production is explained by extensive cultivation areas, a high level of industry intensification, the introduction of modern technologies, and stable domestic demand. China's share in production among the seven leading countries exceeded 49% in 2024, indicating the country's dominant role in the global tomato market.

Table 3

Tomato production in leading producer countries, million tons

Year	Leading tomato producing countries								% of world production
	China	Egypt	India	Italy	Nigeria	Turkey	USA	Seven countries together	
2000	22.3	6.8	7.4	7.5	1.3	8.9	12.6	66.8	61.1
2010	46.9	8.5	12.4	6.0	1.8	10.1	14.1	99.8	64.8
2015	55.6	7.7	16.4	6.4	4.2	12.6	14.6	117.5	65.9
2020	61.1	6.5	20.6	6.2	3.4	13.2	10.9	121.9	66.4
2022	61.9	6.4	20.7	6.1	3.6	13.0	10.2	121.9	67.2
2024	61.7	7.5	21.3	6.0	3.7	14.6	10.7	125.5	66.6

Source: FAOSTAT, 2026

Significant production growth is also characteristic of India, where gross tomato production increased from 7.4 million t in 2000 to 21.3 million t in 2024, or nearly threefold. High growth rates were also observed in Turkey, where production volumes increased from 8.9 to 14.6 million t. Turkey is one of the leading exporters of fresh tomatoes and processed tomato products, while favorable soil and climatic conditions ensure stable development of the vegetable production sector. In Nigeria, production increased from 1.3 to 3.7 million t, or nearly threefold.

Egypt and Italy are characterized by relative stability in production volumes. In Egypt, gross tomato production fluctuated within the range of 6.4–8.5 million t, while

in Italy it remained at approximately 6.0–7.5 million t. Despite the absence of significant growth, these countries remain important tomato producers, primarily focused on high-quality products and the processing industry.

A different trend has been observed in the United States, where production volumes declined from the peak level recorded in 2015 (14.6 million t) to 10.7 million t in 2024. This decline is associated with changes in the structure of agricultural production, high production costs, and water shortages in traditional cultivation regions.

Analysis of global tomato yields indicates an overall upward trend during 2000–2024. The global average yield increased from 28.4 to 36.8 t/ha, or by 29.6%, as a result of improvements in cultivation technologies, the introduction of high-yielding cultivars and hybrids, the development of irrigation systems, and increasing levels of vegetable production intensification.

Throughout the entire study period, the highest yield indicators were characteristic of the countries of the Americas and Oceania. In the Americas, tomato yields increased from 44.2 t/ha in 2000 to 63.4 t/ha in 2024, reaching a maximum of 66.1 t/ha in 2023. The high level of productivity is explained by the widespread use of intensive technologies, mechanized harvesting, drip irrigation systems, and high-yielding hybrids intended for the processing industry.

In Oceania, tomato yields remained the highest in the world and reached 79.1 t/ha in 2024, which was almost 1.5 times higher than the level recorded in 2000. At the same time, the region is characterized by significant year-to-year fluctuations in yield indicators due to the influence of weather conditions and the limited cultivation areas of the crop.

In European countries, tomato yields increased from 31.0 to 56.4 t/ha, or nearly 1.8-fold, indicating a high level of technological support within the industry, extensive cultivation under protected conditions, and the use of modern agrotechnological practices.

The Asian region was characterized by an increase in yields from 27.1 to 43.0 t/ha. This positive trend is largely associated with the rapid development of vegetable production in China and India, which account for a significant share of global tomato production.

The lowest yield indicators throughout the study period were characteristic of Africa, where yields in 2024 amounted to only 15.8 t/ha. Moreover, during 2010–2019, the region experienced a certain decline in crop productivity as a result of insufficient technological support, limited irrigation, soil degradation, and the substantial impact of arid climatic conditions.

Analysis of tomato yield dynamics in the leading producing countries indicates a general trend toward increasing productivity. During 2000–2024, the most substantial yield increases among the major producers were observed in Turkey – from 42.7 to 80.2 t/ha – as well as in China – from 33.1 to 56.4 t/ha (Table 4). Significant growth rates were also characteristic of India, although the yield level in 2024 remained relatively low at 25.0 t/ha. In Italy and Egypt, yield indicators were characterized by relative stability with a tendency toward moderate growth, whereas in the United States yield levels exceeded 100 t/ha in 2023–2024, indicating a highly advanced level of technological development in the sector.

The lowest yield levels among leading producers are traditionally observed in Nigeria, where yield in 2024 amounted to only 4.5 t/ha, indicating the predominance of extensive production technologies and limited resource availability.

In Ukraine, a stable upward trend in tomato yield has been observed: during 2000–2024, the indicator increased from 9.7 t/ha to 26.2 t/ha, reflecting the intensification of production processes and improvements in varietal and hybrid composition. Despite the overall positive dynamics and the achievement of a maximum level in 2021 (32.3 t/ha), a subsequent decline in yield has been recorded. This downward trajectory is attributed to the destructive impact of military-related factors, which led to disruptions in logistics chains, shortages of production resources, and violations of standard agrotechnological practices. It should be noted that even despite long-term growth, the yield level in the domestic agricultural sector remains significantly lower than that of leading countries, indicating considerable untapped potential for further technological modernization of the industry.

Table 4

Trends in tomato yield in Ukraine versus global leaders in production and yield, t/ha

Year	Leading tomato producing countries								Leading countries by tomato yield		
	China	Egypt	India	Italy	Nigeria	Turkey	Ukraine	USA	Belgium	Great Britain	Nether-lands
2000	33.1	34.7	16.2	55.0	6.0	42.7	9.7	74.9	240.3	377.0	433.3
2010	49.3	39.5	19.6	50.7	6.6	56.1	21.8	88.5	473.3	411.6	486.3
2015	54.0	39.3	21.4	59.8	7.6	67.5	30.2	89.5	496.2	419.0	507.1
2020	55.2	40.7	25.1	62.6	3.6	75.7	30.0	99.1	502.4	345.1	486.6
2021	56.5	42.6	25.1	65.1	3.7	79.3	32.3	93.1	448.7	351.1	475.7
2022	56.5	40.4	24.5	62.9	3.6	81.9	24.4	93.0	466.9	373.3	423.1
2023	56.1	42.9	24.1	60.8	4.5	80.0	27.6	101.9	452.7	363.5	410.2
2024	56.4	42.9	25.0	58.6	4.5	80.2	26.2	100.8	489.4	358.3	478.9

Source: FAOSTAT, 2026

The highest tomato yield levels are formed in Western European countries, which maintain a stable global leadership in crop productivity. In particular, in 2024 yields reached 489.4 t/ha in Belgium, 478.9 t/ha in the Netherlands, and 358.3 t/ha in the United Kingdom. Such exceptionally high values are explained by the predominant cultivation of tomatoes in highly technological greenhouse complexes, using automated nutrient supply systems, climate control technologies, and innovative production solutions that ensure maximum resource-use efficiency and full realization of crop potential.

The obtained results indicate that tomato yield levels worldwide are determined primarily by the degree of technological intensification of production, the efficiency of irrigation systems, and the scale of implementation of modern greenhouse technologies, which ensure a substantial increase in crop productivity regardless of natural and climatic conditions.

Conclusions and prospects. The conducted analysis demonstrates a stable upward trend in global tomato production, driven both by the expansion of cultivated areas and by the intensification of production technologies. At the same time, Ukraine is experiencing a reduction in cultivated areas and destabilization of production processes caused by security and economic factors. Nevertheless, the positive dynamics of yield indicate significant potential within the sector. To realize this potential, it is advisable to focus

efforts on the implementation of innovative agricultural technologies, the development of greenhouse production, the expansion and modernization of irrigation systems, and the optimization of crop structure. A priority direction is the restoration of infrastructure, adaptation of production to global climate change, and improvement of resource-use efficiency, which will contribute to strengthening the competitiveness of domestic vegetable production.

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