Received: 15.08.2024. Revised: 15.01.2025. Accepted: 13.03.2025.

EKONOMIKA APK

https://doi.org/10.32317/ekon.apk/2.2025.39

Ekonomika APK, 32(2), 39-49

UDC 338.439.5:338.439.63:634.1.076

Prospects for meeting the needs of the most common types of fruit in Ukraine

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► **Abstract.** During the war, there is a need to provide all market participants with fruit products mainly of Ukrainian production and reduce import dependence. To do this, it is important to establish indicators of the actual level of consumption, general and internal needs in the future, and opportunities for their provision. The purpose of the study was to establish and evaluate the actual fruit consumption fund in Ukraine, considering the food imbalance during the war, and prospective consumption indicators, needs, and possible sources of their coverage. A detailed analysis of the market environment, its changes and mutual influence was based on the balance sheet method, which provided a comprehensive study of the market situation and allowed modelling the economic situation for the future. Correlation and regression analysis techniques were used to determine the prospective parameters of the Ukrainian market. It has been established that in Ukraine the development of fruit supply is carried out in an unorganised manner, given the concentration of their main production in households – by 80%. This leads to differentiation in ensuring consumer demand of the population in the context of regions of the country, by product range and variety, and by place of residence. The main share of fruit production (mainly pome fruits – 90%) is concentrated in the Vinnytsia Oblast (13%). Due to the war, the gross harvest decreased most in Zaporizhzhia, Donetsk, Mykolaiv, Kharkiv, and Dnipro oblasts, which makes it necessary to optimise interregional logistics. The consumption fund is characterised by a

► **Suggested Citation**: Salo, I., Grynchuk, Yu., Svynous, N., Havryk, O., & Grynchuk, K. (2025). Prospects for meeting the needs of the most common types of fruit in Ukraine. *Ekonomika APK*, 32(2), 39-49. doi: 10.32317/ekon.apk/2.2025.39.

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dynamic decline, which resulted in 80.4% of the population's demand for fresh and processed fruit being met. The market capacity covers demand by only 40%, which indicates a high level of natural production and self-sufficiency of the population. In the long term, a slight increase in Ukrainian production, supplies of objectively necessary imports (citrus fruits, bananas), and meeting the domestic needs of the population by 86.8% is expected in 2030. In the future, considering the need to expand industrial intensive horticulture on an innovative basis, for optimal provision of general needs for fruits, state financial support for this type of activity is necessary. The study results should be used in the development of a long-term food supply programme for the short term in the context of optimal provision of fresh and processed fruit products to the population and all market operators

Keywords: production; supply; demand; consumption fund; market capacity; general needs

Introduction

In the current economic development environment in Ukraine, given the war, it is not easy to achieve efficiency in agricultural production, sales, and meeting the needs of all market operators. This is especially true for horticultural products, the cultivation of which is a complex and time-consuming process that requires constant investment in the creation and maintenance of plantings for many years. In this case, the producers will receive a net profit only in a few years when the plantations start bearing fruit. That is, investing in such a business, even without considering possible losses due to the war, is quite risky. In addition, weather conditions, especially changes in climatic conditions, such as drought and heat, have a significant impact on fruit yields. Because of this, the development of the horticulture industry, the Ukrainian fruit market, investment support, supply formation, consumer demand, and needs is of great interest to researchers.

Research of the fruit market, in particular, its parameters of demand, supply, price situation, and the rationality of consumption, the development of internal and external sales channels, the formation of the horticulture industry on innovative principles, investment support for fruit and vegetable regional production are reflected in the papers by L. Yatsyshina (2019), T. Lozova *et al.* (2020) and O. Cherevko *et al.* (2021). Despite the fact that the main share of fruits is produced by households, that is, there are a large number of small producers with small batches of products that mostly do not meet the standards, it is relevant to study the competitive advantages of producers in the fruit market and compare Ukrainian production indicators with the world, establish positions on the international market, which were carried out by I. Kolokolchykova (2019) and N. Rozhko (2020). The profitability of fruit production significantly depends on the speed of their sale through the most efficient channels and storage capabilities, including during transportation. Therefore, it is quite timely to investigate the impact of marketing product policy on the logistics activities of horticultural enterprises, their export potential, which is revealed in the papers by O. Bochko *et al.* (2020) and L. Galat (2021).

Given the limited budget financing of the horticulture industry and in general state support for the development of the Ukrainian fruit market during the war, additional study is required on the issues of fruit production by various categories of farms in modern conditions, the development of a consumption fund, future needs, and sources of their provision. The purpose of the study was to assess the consumer balance of fruits in Ukraine, considering modern economic realities and establishing prospects for ensuring demand and covering needs.

Literature review

Due to the situation that has developed in Ukraine for the period 2022-2024, researchers are increasingly focusing on comparing economic indicators before and during the war. Attention was also focused on the main issue that concerns, in fact, every researcher in Ukraine – what to do in the future for the further development of agriculture on an innovative basis, the agricultural market and, most importantly, the rational provision of the population with the necessary food. Such studies are revealed in the papers by I. Dontsova *et al.* (2022). Thus, the researchers investigated the problems of fruit market development, in particular: reduction of fruit-bearing areas due to military operations in the country, and therefore, gross harvest, crop losses due to late harvesting, increased logistics costs, complexity of transportation and rapid sales, higher prices due to low levels of material support for the population. More detailed analysis of apples, the main fruit in Ukraine in terms of production and processing, was carried out by V. Luzhanskyi (2024). His research focused on the development and evaluation of balance sheet indicators, in particular, the supply and demand of fresh and processed apples and the factors that influence the development of equilibrium of these indicators.

The issue of developing the organic fruit market is becoming increasingly relevant, given the popularisation of healthy nutrition among the population of Ukraine and the world as a whole. Thus, the comparative characteristics of organic agricultural land areas between countries of the world, the development of economic structures engaged in organic fruit cultivation, and, in general, the study of the state of the organic market were carried out by D. Granatstein *et al.* (2016). The active development of organic fruit production, the dynamic growth of operators in this area, and the prospects for further development of organic gardening were noted by I. Horodniak & S. Petrovskyi (2023). They emphasised more specifically that this also applies to processed products.

Processing enterprises serve as an important channel for fruit sales for Ukrainian horticultural enterprises. However, it should be noted that on the one hand, this is a positive phenomenon from the standpoint of the existing possibility of rapid sale of large-scale batches of fruits with excessive crop surpluses and the need for its storage, on the other – negative, since the products are sold at significantly lower prices than for fresh consumption and the owners

get a much lower effect. The issues of fruit processing, in particular, for dried fruits, sweets, sales problems, development of processing enterprises, optimisation of logistics activities and the relationship between processors and direct producers were considered by S. Kierczyńska (2019) and L. Beztelesna & V. Butkevych (2023).

Given that the main share of fruits, which is on average about 85%, in Ukraine is produced by households, the market remains unorganised, with chaotic production volumes and supply. When it comes to entering European markets, it is clear that these manufacturers cannot be competitive by any criteria. When forming a long-term programme for the development of the fruit market, as a rule, all attention is focused on the possibility of expanding production by horticultural enterprises and providing them with state support, including financial support. Only in this way is it possible to ensure the stability of supply and reduce differentiation in the diet of the population. Research on the prospects for the development of industrial fruit and vegetable production, ensuring proper product quality and appropriate prices, export-import supplies of fruits, optimisation of sales was carried out by J. Krykavskyy *et al.* (2021) and L.T. Putri & A. Azhari (2022).

During the period of Ukraine's European integration, studies are relevant and important not only to provide the population with fruit products, reduce import dependence, but also to expand the export potential of horticulture, and the effectiveness of export-import trade. Summarising the results, it should be noted that when forming the Ukrainian product offer in the future, manufacturers should consider consumer demand for organic products, the needs of foreign European markets, product compliance with international standards, and the possibility of diversifying sales channels.

▸ Materials and methods

The variability of the Ukrainian fruit market was manifested in changes in its conjuncture. A detailed analysis of the market environment, its changes and mutual influence was usually based on the balance sheet method, which provided a comprehensive study of the market situation and allowed modelling the economic situation for the future to rationally meet the needs of fruit consumers. The most common methods of correlation and regression analysis in economic research were used to predict the main parameters of the Ukrainian market. The conducted research was based on methodological approaches to determining balance sheet indicators – the total supply and demand of any market of agricultural products and, as a result, the consumption fund.

The research was conducted mainly at the macro level, that is, at the country level. At the micro level, the regional distribution and changes in the structure of production of certain types of fruits before and during the war in Ukraine were analysed. The study used data for the last three pre-war years – 2019-2021 and for comparison indicators during the war for 2022-2023. The paper described the indicators of fruit production (area of fruit-bearing plantings, yield, and gross harvest) in the country and separately by region, consumption (supply, demand, consumption fund, need) and foreign trade (export, import). It is worth noting that in 2022-2023, statistics were provided without considering the territories temporarily occupied by the Russian Federation and parts of the territories where military operations are being conducted.

A step-by-step algorithm for determining the total supply of fruits, total demand, and consumption fund in accordance with the existing methodology, and general and internal needs was established (Letter of the Ministry of Economy and European Integration of Ukraine and the Ministry of Agriculture of Ukraine, 2003):

1. General offer (including commercial and natural output) of the domestic fruit market was defined as the sum of fruit production, import supplies and stocks at the beginning of the year:

$$GO = P + I + Sby, \quad (1)$$

where GO – general offer of fruits, thous. t; P – fruit production, thous. t; I – fruit import, thous. t; Sby – stock at the beginning of the year, thous. t.

2. Total demand (including marketable and natural volume of products) was determined by the equation:

$$TD = GO - Bey, \quad (2)$$

where TD – total demand of fruits, thous. t; GO – general offer of fruits, thous. t; Bey – balance at the end of the year, thous. t.

3. Domestic demand was calculated using the equation:

$$DD = GO - E - Bey, \quad (3)$$

where DD – domestic demand of fruits, thous. t; GO – general offer of fruits, thous. t; E – fruit export, thous. t; Bey – balance at the end of the year, thous. t.

4. Consumption fund was formed exclusively from products that are used for consumption by the population in fresh and processed form:

$$CF = GO - C - L - E - Bey, \quad (4)$$

where CF – consumption fund of fruits, thous. t; GO – general offer of fruits, thous. t; C – fruit consumption in various areas (for feed, seeds, processing for non-food needs, thous. t; L – fruit loss, thous. t; E – fruit export, thous. t; Bey – balance at the end of the year, thous. t.

5. General needs include, in addition to the volume of internal fruit supply (internal needs), the need for fruit processing and export supplies:

$$GN = PN + NP + E, \quad (5)$$

where GN – general needs, thous. t; PN – population needs, thous. t; NP – fruit needs for processing, thous. t; E – fruit export, thous. t.

6. Population needs for fresh and processed fruits were established based on rational norms of consumption of products per person per year, determined by the equation:

$$PN = PS \cdot RC, \quad (6)$$

where PN – population needs, thous. t; PS – population size, persons; RC – rational consumption rate, kg/person/year.

The information base for conducting research was legislative acts, monographs and scientific and analytical publications on the development of agricultural markets, statistics were available on the Official Website of the State Statistics Service of Ukraine (n.d.). Different types of fruits have their own specifics of cultivation, storage, transportation, sale, and pricing, however, the main types of fruit crops were statistically grouped by production, balance indicators, sales, and prices to reveal the economic situation in the country at the macro level. These indicators were also grouped by individual natural and climatic zones and regions to reveal the micro-level situation. For this purpose, the corresponding methods of statistical grouping by State Statistics Service of Ukraine (n.d.) were used. In view of this, when conducting macro-level studies, official statistical indicators for the "fruits" group were used in general and in the context of "fruits of pome crops", "fruits of stone crops", "nuts". A separate group was represented by fruits of objectively necessary imports that do not have a natural growing area in Ukraine.

▸ Results and discussion

In Ukraine, fruits are produced by agricultural enterprises and households. The participation of these categories of farms in the development of market conditions differs significantly. Ultimately, they are different from the standpoint of legislation, and in terms of production and sales volumes, structure and, most importantly, the purpose of their activities. If the main goal of horticultural enterprises is to obtain the highest possible profits from their production activities, then for households it is mainly to provide for their own needs and only then participate in commodity-money relations. For more than a decade, households have been producing the bulk of fruit. Thus, for the period 2019-2023, this is 80-87% of total production volumes or 1,741-2,096 thous. t (Table 1). The main reason that forces these farms to sell fruit products, in addition to the possibility of getting rid of leftovers, especially in too productive years, is the low effective demand of the population. Due to insufficient financial support, especially during the war, the efficiency of horticultural enterprises significantly depends on weather conditions and the ability to establish sales channels for products at the peak of harvest. Ultimately, providing storage facilities for long-term storage of fruits remains insufficient and financially costly, especially if there are no agreements on the effective sale of products in the future.

Table 1. Dynamics of area, yield, gross fruit harvest by categories of farms in Ukraine

Years	All categories of farms	Including			
		agricultural enterprises	in % to all categories of farms	farms of the population	in % to all categories of farms
Area of fruit-bearing plantings, thous. ha					
2019	212	61	28.8	151	71.2
2020	213	59	27.7	154	72.3
2021	171	38	22.3	133	77.7
2022	153	28	18.2	124	81.1
2023	150	29	19.6	121	80.4
Yield, t/ha					
2019	81.4	37.1	45.6	99.3	122.0
2020	81.7	38.3	46.9	98.4	120.4
2021	12.3	11.8	96.1	12.4	101.1
2022	12.2	12.2	99.5	12.3	101.0
2023	12.5	13.0	103.9	12.4	99.0
Gross harvest, thous. t					
2019	1,722	227	13.2	1,495	86.8
2020	1,741	226	13.0	1,515	87.0
2021	2,096	449	21.4	1,648	78.6
2022	1,871	339	18.1	1,532	81.9
2023	1,875	381	20.3	1,494	79.7

Source: calculated by the authors based on State Statistics Service of Ukraine (n.d.)

The regional structure of fruit production in Ukraine is significantly different. Moreover, it has changed due to the war in the country, the loss of plantations, the retirement of old orchards from commercial fruit bearing, and the almost absent establishment of new orchards. Changes in the regional structure of fruit production before (2021) and during (2023) the war, including pome and stone fruits and nuts, are described in Table 2.

Table 2. Structure of production of the main types of fruits by regions of Ukraine, %

Oblasts	Fruits		Pome fruits		Stone fruits		Nuts	
	2021	2023 *	2021	2023 *	2021	2023 *	2021	2023 *
Vinnytsia	12.5	13.4	16.6	16.9	3.2	4.5	3.7	7.2
Volyn	1.7	1.9	1.9	2.1	1.5	1.7	1.1	1.1
Dnipro	6.7	5.9	6.0	5.0	8.0	8.3	9.3	7.2
Donetsk	4.0	1.3	2.6	0.7	7.1	2.7	7.8	2.6
Zhytomyr	1.8	2.0	2.0	2.1	1.2	1.4	2.4	2.4
Zakarpattia	5.1	5.7	6.1	6.6	2.0	2.5	6.1	7.2
Zaporizhzhia	2.8	0.7	1.6	0.4	5.7	1.7	3.4	0.8
Ivano-Frankivsk	2.8	3.0	3.1	3.3	1.9	2.3	2.3	2.5
Kyiv	3.8	4.1	4.0	4.1	3.4	3.9	3.5	4.3
Kirovohrad	1.0	1.2	0.4	0.6	1.9	2.3	3.9	4.7
Luhansk	2.7	2.1	1.7	1.3	5.9	4.6	0.6	0.4
Lviv	5.9	7.4	6.4	8.1	4.7	6.0	4.9	5.2
Mykolaiv	1.3	0.9	0.8	0.6	2.3	1.6	2.9	2.1
Odesa	4.4	4.8	2.2	2.2	9.9	11.8	7.6	7.5
Poltava	5.5	6.2	4.5	4.8	8.3	10.2	6.3	6.8
Rivne	4.1	4.4	2.8	2.8	7.4	8.8	5.0	5.4
Sumy	0.7	0.6	0.7	0.6	0.8	0.9	0.1	0.1
Ternopil	4.6	5.5	5.7	6.8	2.0	2.3	2.0	2.0
Kharkiv	2.1	1.4	1.8	1.1	3.1	2.6	0.9	0.7
Kherson	1.7	-	1.2	-	3.2	-	0.5	-
Khmelnytskyi	10.2	11.1	11.2	11.7	7.9	9.5	8.3	9.3
Cherkasy	1.5	1.6	0.9	0.9	1.5	1.4	8.8	11.6
Chernivtsi	12.4	14.0	15.0	16.5	6.2	7.6	8.3	8.4
Chernihiv	0.7	0.8	0.7	0.7	1.0	1.1	0.3	0.4
Production in Ukraine, thous. t	**2,096**	**1,875**	**1,449**	**1,323**	**5,317**	**4,454**	**1,155**	**1,069**

Notes: * – data without considering the territories temporarily occupied by the Russian Federation and parts of the territories where military operations are (were) being conducted
Source: calculated by the authors based on State Statistics Service of Ukraine (n.d.)

For all types of fruits, there is a decrease in production volumes during the war: pome fruits – by 9%, stone fruits – by 16%, nuts – by 7%. However, it should be borne in mind that some of the data was not statistically considered for the territories where the fighting continues. It is also worth noting that the main share of fruit production of pome fruits – up to 70% before and during the war (on average up to 1 mln. t) is concentrated in Vinnytsia, Dnipro, Zakarpattia, Lviv, Ternopil, Khmelnytskyi, and Chernivtsi oblasts. The leaders among them are Vinnytsia and Chernivtsi oblasts. Thus, it is in the Vinnytsia Oblast that the main production of apples in Ukraine is concentrated – up to 20%, and in Chernivtsi oblast, pears – 16%. During the war, the production of pome fruits significantly decreased in Zaporizhzhia, Donetsk, Kharkiv, Mykolaiv, Luhansk, and Dnipro oblasts by 80.74%, 43%, 39%, 28%, and 24%, respectively. Moreover, production in the Kirovohrad Oblast increased significantly – by 24%, which is explained by the entry of young apple orchards into commercial fruiting.

Regional stone fruit production experienced the greatest structural shift during the war. Thus, before the war in 2021, the main share of gross collections (an average of 61%) was concentrated mainly in the Dnipro, Donetsk, Zaporizhzhia, Odesa, Poltava, Rivne, Khmelnitsky, Chernivtsi oblasts, which is 321 thous. t. During the war, stone fruit production in Zaporizhzhia, Donetsk, Mykolaiv, Luhansk, Kharkiv, and Cherkasy oblasts decreased by 74%, 68%, 43%, 34%, 30%, and 21%, respectively. However, production in the Vinnytsia Oblast increased by 20%.

Nut cultivation was concentrated in 2021 mainly in Dnipro, Donetsk, Zakarpattia, Odesa, Poltava, Khmelnytskyi, Cherkasy, and Chernivtsi oblasts – up to 65%. During the war, production decreased the most in the Donetsk and Zaporizhzhia oblasts – by 69% and 78%. Plantings entered commercial fruiting in the Vinnytsia Oblast, due to which the gross harvest of nuts, on the contrary, increased by 79% to 7.7 thous. t. More than 82% of fruit-bearing walnut plantations (13.3 thous. ha) are concentrated in households, which is more than 95% of total production. Because of this, the study suggests that after the war, the production of nuts (mainly walnuts – 99.9%) will recover with a minimum level of financial investment.

Summing up, the main share of gross fruit collections for all categories of farms is concentrated in the Vinnytsia Oblast – an average of 13% (2.5-2.6 mln. t). Most of

all, their production decreased during the war in Zaporizhzhia, Donetsk, Mykolaiv, Kharkiv, and Dnipro oblasts – by 77%, 71%, 40%, 38%, and 21%, respectively. There are no data on the state of plantings in the Kherson Oblast. Given the existing reduction and structural changes in regional production of various types of fruits due to the war in Ukraine, the deterioration of the situation not only with sufficient consumption, but also availability, it is especially important to establish effective and timely interregional logistics, given the concentration of the main share of gross fruit collections in households.

When drawing up a balance sheet of fruits, their wide interspecies range and channels of supply should be considered. Thus, first of all, this affects the calculation of such items as feed, seeds, processing for non-food needs and product losses. For example, if the permissible fruit losses in agricultural enterprises are up to 5%, then in households this figure is several times higher. During 2019-2023, there was a dynamic decrease in the fruit consumption fund – from 2,382 thous. t in 2019 to 2,001 thous. t in 2023, that is, by 15.6% (Table 3). However, mainly due to a 20.8% reduction in the population during this period to 33.2 million people, the level of consumption increased by 6.2% to 60.3 kg per person per year. The established consumer demand corresponds to a rational consumption rate of 75 kg per person per year by 80.4%.

Table 3. Fruit balance in Ukraine, thous. t

Indicators	Years					Index 2023 to 2019
	2019	2020	2021	2022	2023	
General offer	4,008	3,746	3,944	3,602	3,532	0.9
Inventory at the beginning of the year	1,236	1,110	972	1,170	1,045	0.8
Production	1,989	1,741	2,096	1,871	1,875	0.9
Import	782	896	875	560	612	0.8
Total demand	2,898	2,775	2,773	2,557	2,485	0.9
Domestic demand	2,715	2,647	2,618	2,388	2,315	0.9
food	2,382	2,356	2,267	2,074	2,001	0.8
feed	41	38	41	38	37	0.9
seeds	3	3	3	3	3	1.0
processing for non-food needs	239	209	252	225	225	0.9
losses	50	42	55	48	49	1.0
Export	183	128	155	169	169	0.9
Balance at the end of the year	1,110	972	1,170	1,045	1,047	0.9
Comparison of final balances with demand	0.38	0.35	0.42	0.41	0.42	-
Consumption fund	2,382	2,356	2,267	2,074	2,001	0.8
Market capacity	1,453	1,437	1,383	1,244	1,201	0.8
Consumption per person per year, kg	56.8	56.6	55.1	59.3	60.3	1.1

Source: calculated by the authors based on State Statistics Service of Ukraine (n.d.)

The fruit market capacity calculated in dynamics for 2019-2023 is 1,201-1,453 thous. t. This is exactly the volume of fruit supply that goes through all stages of commodity-money market relations. This indicator shows that the consumer demand of the population is met only up to 40%. That is, there is a high level of self-sufficiency of the population at the expense of their own natural production. As a result, this leads to differentiation in fruit consumption – interregional (between urban and rural populations), interspecific (between pomological varieties), etc. Thus, the rural population, in contrast to the urban population, consumes less fruits of objectively necessary imports, in particular, citrus fruits and bananas.

In the development of the fruit market capacity by all categories of farms, i.e., agricultural enterprises and households in different years, mainly depending on the volume of their production, a share is allocated in the range of 35-45%. The volume of imports as part of the capacity is up to 65%. The total demand for fruits was set considering the volume of products for fresh consumption, direction for processing, and export supplies. In 2030, the total demand may reach 2,635 thous. t (Table 4). It is planned to expand the fruit consumption fund to 2,288 thous. t by 2030 by increasing their production volumes to 2,100 thous. t, including pome fruits – 1,480 thous. t, stone fruits – 500 thous. t, and nuts – 120 thous. t.

Table 4. Total demand for fruits and sources of coverage in 2030

Products	Rational consumption rate, kg/ person/year	Total demand, thous. t				Sources of coverage of needs, thous. t			Consumption fund, thous. t	Share of coverage of internal needs, %
		total	of them		incl. for recycling	agricultural enterprises	households	import		
			population	export						
Fruits, including:	75	2,635	2,400	235	130	420	1,680	125	2,288	86.8
▸ pome fruits	57.5	2,012	1,840	172	100	400	1,080	25	1,638	81.4

Table 4, Continued

Products	Rational consumption rate, kg/ person/year	Total demand, thous. t				Sources of coverage of needs, thous. t			Consumption fund, thous. t	Share of coverage of internal needs, %
		total	of them		incl. for recycling	agricultural enterprises	households	import		
			population	export						
▸ stone fruits	16	560	512	48	28	15	485	80	620	110.7
▸ nuts	1.5	63	48	15	2	5	115	20	30	47.6
Citrus fruits and bananas	3	96	96	-	6	-	-	800	784	816.2

Source: calculated based on the authors' research

Consequently, the share of covering domestic needs in 2030 may reach 86.8%, including at the expense of Ukrainian production by 91.8%. This volume of the fruit consumption fund can meet the consumer demand of the population, with its projected number of 32 million people for 2030, by 95.3%, which is 71.5 kg per person per year, including pome fruits by 89.0% (51.2 kg), stone fruits – 121.1% (19.4 kg) and nuts – 62.5% (0.9 kg), objectively necessary import supplies – 816.7% (24.5 kg) (Kurylo *et al.*, 2023). In the near future, the main role in Ukrainian production of all types of fruits will traditionally belong to households.

The use of intensive technologies in the creation and maintenance of gardens of various structures is important in increasing the competitiveness of horticultural products on the Ukrainian and global markets. This allows increasing the productivity of plantings almost three times, for example, apple and pear trees – up to 35-45 t/ha, cherries and black cherries – 15-20, plums – 30-40 t/ha, etc. In general, dense gardens on low-growing clone rootstocks are considered promising. The improvement of the breed and varietal composition of fruit plantations is seen in increasing the share of winter varieties of pome and early stone fruits, in particular, sweet cherries, along with improving the storage and transportation of fruits, the use of commercial processing. This will allow expanding the export of fresh fruits in the future. In the presence of a specially equipped storage facility, horticultural enterprises can receive almost twice as high profits as when selling fruits during their mass fruiting period.

During the study period for 2019-2023, state financial support was provided in the field of gardening, the amount of which amounted to UAH 400-450 million annually. The funds were used by production workers for the purchase of seedlings, the construction of trellises, and the installation of drip irrigation systems, for the construction or renewal of refrigeration facilities, storage facilities, the purchase of equipment for commodity refinement, complete set of fruit and vegetable products, and necessary equipment or other installations important in the production process, including from foreign companies. In 2023, according to the Resolution of the Cabinet of Ministers of Ukraine No. 738 (2022), UAH 432.8 million was allocated for grants for the development of horticulture, berry growing, and viticulture. Horticulture will continue to require additional state financial support, especially during the war, due to the critical reduction in the area of fruit-bearing plantings and the need to recreate gardens at least at the level of old plantings that have left commercial fruiting.

In ensuring the needs of the population with fruit products, a significant place was occupied not only by the sufficiency indicator, but also by access to fruit consumption by their range and variety. This is especially true for people with low levels of financial security. Therefore, it is quite important to develop an effective sales system depending on the territorial location and population density. One of the best sales options is mobile grocery markets. The relationship between the level of consumption and the existing functioning of such markets was investigated by B.-S. Hsiao *et al.* (2019). Moreover, researchers were exploring the relationship between meeting the needs of the population with fruit and its access to produce and obesity. Such studies were conducted on a sample of more than 3,000 people in five countries of the world by S. Yang *et al.* (2021). Based on correlation and regression analysis, a significant level of dependence was established in favour of the need for fruit consumption in accordance with established rational norms.

In Ukraine, as in many countries of the world, there is a differentiation in fruit consumption depending on seasonality and, with low purchasing power, price fluctuations. Analytical studies aimed at the rationality of ensuring consumer demand, investigating the price situation, sales channels, marketing and pricing policies of enterprises, were conducted by K. Chay *et al.* (2019) and F. Bachewe & B. Minten (2023). The need for marketing research in the activities of farms, determining the benefits of selling fruit through different sales channels was noted by H. Ihli *et al.* (2022). Special attention should be paid to research on fruit sales due to their rapid loss of consumer properties, seasonality, overall size, the need to comply with storage technologies and the availability of necessary storage facilities. Studies of various factors and their impact on the efficiency of marketing fruits, in particular mangoes and peaches, through various channels were carried out by D. Endias (2021) and D. Natalchuk & O. Rudnyk-Ivashchenko (2024). The authors of the current study suggest that the optimal sales channel for fruit producers in this case is a network of wholesale fruit and vegetable markets. The need for the organisation of functional fruit market centres was noted by S. Rashid *et al.* (2023) and R. Kuralbayeva *et al.* (2023). This can partially solve the problem of access and provision of fruits to various categories of the population.

It should be noted that in the balance sheet compiled in the study, fruit waste is reflected in three items: livestock feed costs, processing for non-food needs, and product

losses. Losses of production, especially in harvest years, mainly apples, are quite noticeable in households, which, in fact, is not statistically recorded. The issue of using fruit waste by anaerobic digestion for the production of biogas was studied by C. Morales-Polo *et al.* (2019). There is an acute issue of fruit loss in the process of the entire consumer chain "production-trade-consumer" among German market operators, especially in too productive years, which was investigated by R. Herzberg *et al.* (2022). The study of the behaviour of fruit sellers at a high level of product waste, including in wholesale fruit and vegetable markets, was carried out by B. Abadi *et al.* (2021). The researchers also investigated the behaviour of direct consumers in handling fruit waste. These cross-sectional studies were ultimately aimed at improving the quality of management and increasing the sales impact. These studies, together with the current research, once again confirmed the urgent need to develop the fruit processing industry in Ukraine.

Analytical studies of fruit production by various categories of farms were carried out by R.S. Sengar & R. Varsha (2020). Especially relevant is the issue of selling fruits by small commodity producers – households of the population and determining their place in providing the population in the future. The issue of using products for their own consumption in fresh form or processing was not discussed. The problem of selling crop surpluses is acute when quality requirements and compliance with standards are tightened, due to the fact that these producers occupy a significant share in gross fees. Similar studies on the place of small producers in Bosnia and Herzegovina in the food system and the problem of their inclusion in the modern market chain have been carried out by I. Plazibat *et al.* (2016). According to the authors of the above study, the real guide for households to occupy their market niche is the creation of consumer cooperatives, which would solve the issue of forming standard batches of fruit products. This is quite relevant for walnuts, which for a long time occupied the main share in Ukrainian export supplies and are in quite high demand outside of Ukraine (fresh, as raw materials for processing).

The need for state financing of horticulture to expand industrial production and, accordingly, guaranteed (controlled) provision of internal and external needs for fresh and processed fruits is debatable. The need for state regulation, including financial support for the agricultural market, despite the status of "Ukraine as an EU candidate", and thus intensification of cooperation with the European Union, which ultimately leads to a reduction in state protectionism in various areas, is supported by M. Kuryljik & I. Kochan (2024). The researchers, however, suggest that state financial support for horticultural producers is necessary, especially for laying stone fruit plantations.

Gardening is also actively supported in other countries of the world. But given the deterioration of the environment, climate change, and population growth, the problem of providing horticultural products to residents of India is significant. Although India has favourable conditions for growing almost all types of fruit, government intervention and support are necessary for the sustainable development of horticulture, as stated by P. Bakshi *et al.* (2022). In the United States, the development of horticulture is supported by the state and private investors, and scientific research in this area. Efforts are made to overcome misunderstandings and misunderstandings between direct consumers of horticultural products that generate demand and industrial producers to ensure optimal food supply, which has been studied by S. Krishnan *et al.* (2021).

Thus, the most relevant and discussed issues in the development of the fruit market and horticulture in particular, which were investigated by researchers are: development of a high-quality commodity supply of fruits, optimal provision of consumer demand and the needs of the population; the need for marketing research and improvement of the sales policy of horticultural enterprises; the development of the processing industry, rational environmental use of waste. The opinions of researchers are generally well-founded and non-conflicting. However, the issue of the need for financial support for agriculture in various areas, including horticulture, remains debatable. Ultimately, despite the integration of Ukraine into the European space, in 2025, the state remained the main source of investment in the development of Ukrainian industrial horticulture.

▸ Conclusions

The reduction of the area of fruit-bearing plantings in horticultural enterprises and the concentration of the main share of fruit production in households causes an unorganised development of their product supply. There is a reduction and structural changes in regional production of various types of fruits due to the war in Ukraine. This necessitates the optimisation of logistics between operators of the entire food chain – producers, intermediaries, merchants, and consumers. The volume of the fruit market capacity provides consumer demand of the population only up to 40%. That is, most fruit products reach the consumer outside of commodity-money relations.

The total needs for fruits for 2030 are set, which, given the current economic situation in Ukraine and the corresponding state financial support, can be met by 86.8%. Traditionally, the main share in the development of the fruit consumption fund will be occupied by households. It should be noted that these products are uncompetitive and can be used primarily for domestic consumption and processing. The exception is walnuts (peeled and unpeeled), which are purchased by intermediaries from the population and exported mainly as raw materials for the processing industry. Import supplies of fruits will be formed mainly at the expense of citrus fruits and bananas, and export – apples grown by horticultural enterprises. But it is expected that the production of the latter will resume at least to the pre-war level.

In the future, for the expansion of industrial fruit production, it is necessary to regularly provide financial support to horticultural enterprises for the reproduction and care of fruit plantations, storage of crops in specially equipped storage facilities. It is important that gardening develops on an intensive basis, using modern innovative environmentally safe technologies for growing perennial plantings. In further studies, it is necessary to establish the volume of financial investment for laying and caring

for perennial plantings (including by attracting foreign sources), in accordance with their placement in the regional context in the near future, considering the military operations in Ukraine and the presence of uncontrolled territories. After all, the primary task is to provide the population with fresh and processed products, reduce import dependence, and expand the export potential of Ukrainian horticulture.

▸ Acknowledgements
None.

▸ Funding
None.

▸ Conflict of interest
None.

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Перспективи забезпечення потреб найпоширенішими видами плодів в Україні

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Анотація. Під час війни існує необхідність забезпечення усіх учасників ринку плодовою продукцією переважно українського виробництва та зменшення імпортозалежності. Для цього важливо встановити показники фактичного рівня споживання та загальні і внутрішні потреби у перспективі, а також можливості їх забезпечення. Мета статті – встановити та здійснити оцінку фактичного фонду споживання плодів в Україні, враховуючи продовольчий дисбаланс під час війни, та перспективні показники споживання, потреби і можливі джерела їх покриття. В основі детального аналізу ринкового середовища, його змін та взаємовпливу, використано балансовий метод, який забезпечує комплексне вивчення кон'юнктури і дозволяє змоделювати економічну ситуацію на перспективу. При встановленні перспективних параметрів українського ринку застосовувалися прийоми кореляційно-регресійного аналізу. Встановлено, що в Україні формування товарної пропозиції плодів здійснюється неорганізовано, зважаючи на зосередження основного їх виробництва в господарствах населення – на 80 %. Це обумовлює диференціацію у забезпеченні споживчого попиту населення у розрізі регіонів країни, за асортиментом та сортиментом, за місцем проживання. Основна частка виробництва плодів (переважно зерняткових – 90 %) концентрується у Вінницькій області (13 %). Через війну, найбільш знизився валовий збір у Запорізькій, Донецькій, Миколаївській, Харківській та Дніпропетровській областях, що обумовлює необхідність оптимізації міжрегіональної логістики. Фонд споживання характеризується динамічним зменшенням, що обумовило забезпечення попиту населення у свіжих та переробних плодах на 80,4 %. Місткість ринку покриває попит лише на 40 %, що свідчить про високий рівень натурального виробництва та самозабезпеченості населення. У перспективі на 2030 р. очікується незначне збільшення українського виробництва, поставок об'єктивно-необхідного імпорту (цитрусові, банани), забезпечення внутрішніх потреб населення на 86,8 %. У подальшому, зважаючи на необхідність розширення промислового інтенсивного садівництва на інноваційній основі, для оптимального забезпечення загальних потреб у плодах, необхідною є державна фінансова підтримка цього виду діяльності. Результати досліджень слід використати при формуванні перспективної програми продовольчого забезпечення на короткостроковий період у контексті оптимального забезпечення населення та всіх операторів ринку свіжою та переробною плодовою продукцією

Ключові слова: виробництво; пропозиція; попит; фонд споживання; місткість ринку; загальні потреби