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Promoting Green Deal Readiness
in the Eastern Partnership Countries
(PROGRESS)

State Organization
«Institute for Economics and Forecasting
of the National Academy of Sciences of Ukraine»

UKRAINE COUNTRY REPORT for Output I

PROGRESS Stocktaking for Country Framework for Climate Change Adaptation and Resilience for Agriculture and Fruits, Nuts, and Berries

(the study was conducted from April 2024 to December 2024)

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INTRODUCTION

Fruit and berry production is a promising component of Ukraine's agro-industrial complex. It has the potential to enhance the competitiveness of Ukrainian products in global markets, support the development of small and medium-sized agricultural enterprises—particularly in rural regions—and create added value through processing. At the same time, climate change already has a significant impact on this sector due to shifting temperature regimes, uneven precipitation patterns, increased risks of frost and drought, and the spread of pests and diseases. These factors pose new challenges for cultivation and processing, as well as for government bodies tasked with ensuring the sector's systematic adaptation to climate change.

In the context of implementing the State Climate Policy until 2030, and Ukraine's commitments under the Paris Agreement and the EU-Ukraine Association Agreement, a key objective is to integrate climate risks and adaptation measures into all levels of agricultural policy. At the same time, European strategies—such as the European Green Deal, the EU Biodiversity Strategy for 2030, and the Farm to Fork Strategy—are shaping the external political and regulatory environment, to which Ukrainian agricultural production must adapt.

This report aims to provide a comprehensive analytical foundation for formulating evidence-based state policy in the field of climate-resilient fruit and berry production. It addresses the following aspects:

- the current state of production, processing, and export of fruits, berries, and nuts in Ukraine;
- the vulnerability of agricultural value chains to climate change;
- a review of the regulatory and legal framework, with emphasis on the need to align it with European standards;
- gender aspects in Ukraine's fruit and berry sector as a component of inclusive rural development policy.

The first chapter highlights the regional structure of major crop production, current export trends, and the status of the domestic processing market. Particular attention is given to the impacts of climate change on product quality, yield stability, and logistics.

The second chapter analyzes key policies and regulatory documents related to climate change adaptation. It also examines the implementation of EU directives and requirements for sustainable agricultural production, including GAEC (Good Agricultural and Environmental Conditions) and SMR (Statutory Management Requirements) standards necessary for integration into the EU's Common Agricultural Policy (CAP).

The third chapter focuses on gender disparities in the fruit and berry sector, including access to resources, state support, and participation in decision-making. It underscores the need for gender-sensitive agricultural policy in line with Ukraine's commitments under the UN Convention on the Elimination of All Forms of Discrimination Against Women and the EU's gender equality requirements.

This report was developed with consideration for the needs of farmers preparing for EU accession, as well as for government bodies involved in shaping or implementing agricultural, climate, gender, and trade policies. The materials presented may be used in the development of state support programs, legislative updates, implementation of EU standards, and planning of interagency coordination for agricultural adaptation to climate change.

The research was conducted within the framework of the PROGRESS project, funded by the Federal Ministry for Environment, Nature Conservation, Nuclear Safety and Consumer Protection (BMUV) through the International Climate Initiative (IKI), implemented by the Consortium of organizations under the lead of Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH, the Organisation for Economic Cooperation and Development (OECD), the State Organization "Institute for Economics and Forecasting of the National Academy of Sciences of Ukraine" (IEF).

ANALYSIS OF AGRO-VALUE CHAINS OF FRUITS, BERRIES AND NUTS IN UKRAINE AND CLIMATE CHANGE IMPACTS

01

1.1. Production of fruit, berry, and nut by producers and regions

The cultivation of fruits, berries and nuts in Ukraine has traditionally been widespread throughout the country due to favorable natural and climatic conditions, namely a mild climate, sufficient humidity and a sufficient number of sunny days.

However, over the past 20 years, Ukraine's political and economic environment has undergone changes that have had a significant impact on production. Such changes include accession to the World Trade Organization in 2008, the outbreak of hostilities in the east of the country in 2014, the application of the Deep and Comprehensive Free Trade Area between Ukraine and the EU under the provisions of the EU-Ukraine Association Agreement, which entered into full force on 1 September 2017 and the start of negotiations on accession to the EU. All of this led to a reduction and reformatting of financial state support for the agricultural sector, the formation of new foreign trade relations, changes in the location of production, etc. Full-scale military operations and occupation of part of the country's territory since 24 February 2022 had a significant negative impact on production due to the loss of territories, facilities, plantations, labor, and disruption of logistics routes.

The role of the fruit and berry sector in the national economy. The share fruit and berry sector in agricultural output is estimated to be 1.94% in 2022 and 1.86% in pre-war 2021. Overall, however, it is important for food security and welfare. Fruits and berries are an important part of the diet, but their actual consumption in Ukraine (59 kg per person) is low. Ukrainians consume half as much fruit and berries as EU countries. The level of self-sufficiency in this group of products is not high enough - 79.3% (2021), meaning that domestic production does not cover domestic consumption. Not only exotic fruits and berries are imported, but also traditionally grown in Ukraine apples, pears, apricots, peaches, etc. This indicates the significant potential of the domestic market.

The state of production of fruits, berries and nuts. The structure of Ukraine's pome fruit plantations is dominated by apple and pear trees (99% of the area), stone fruit trees - cherries, plums, cherries and apricots (94%), berry trees – strawberries, raspberries and blackberries, currants (85%), and almost all the area is occupied by walnut plantations (98%).

Over the period 2000-2003, there have been significant changes in the varietal composition, planting areas, yields, and production volumes of fruit and berry crops. The area of plantations declined rapidly over a long period: over 20 years, the area of pome fruits decreased by 2.5 times, stone fruits by 1.5 times, and the area of berry and nut plantations did not change significantly (Fig. 1.1). The pre-war period saw a gradual recovery of the industry, but with the outbreak of full-scale hostilities, the area of plantations decreased again, largely because of the occupation and damage in the frontline areas.

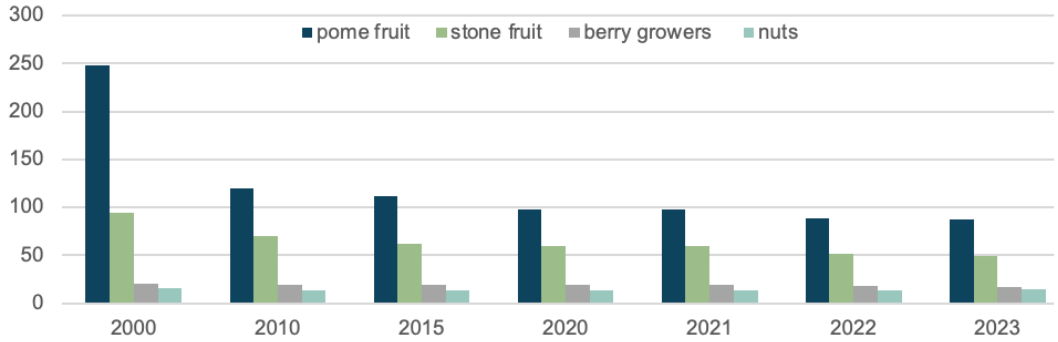


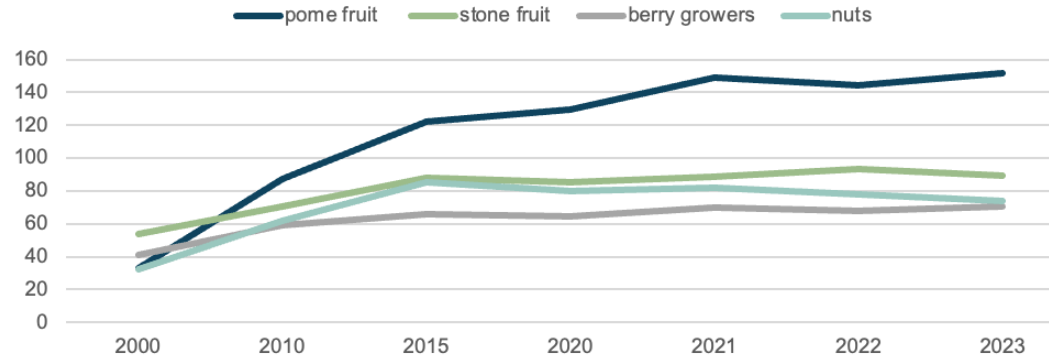
Fig. 1.1. Area of plantations in bearing age, thousand ha

Source: based on data from the State Statistics Service of Ukraine

In the period 2000-2023, there were significant positive changes in the development of this sector of agricultural production. In particular, research farms providing fruit and berry producers with high-quality planting material began to develop actively, and the pace of intensification of the industry increased, resulting in the replacement of outdated inefficient plantations with modern intensive ones. The use of high-quality planting material, intensive technologies and best practices in horticulture, berry and nut growing has resulted in a significant increase in yields.

Fig. 1.2. Yield dynamics, centners per hectare

Source: based on data from the State Statistics Service of Ukraine



Location of fruit, berry and nut production. There have been significant changes in the location of production. They were caused both by the above-mentioned political and economic factors and by climatic changes. In 2000, the main regions (ranked by production volume) in terms of pome fruit production were Dnipropetrovs'k, Zakarpattia, Donetsk, Lviv, and Vinnytsia regions, and now they are Vinnytsia, Chernivtsi, Khmelnytskyi, Lviv, and Ternopil regions. The leaders in stone fruit production in 2000 were Dnipropetrovsk, Donetsk, Kherson, Odesa, and Zaporizhzhia regions, and in 2023 - Odesa, Poltava, Khmelnytskyi, Dnipropetrovsk, and Rivne regions. There have been some changes in the production of berry crops. In 2000, most berries were produced in Donetsk, Dnipropetrovs'k, Lviv, and Zhytomyr regions, and in 2023 - in Dnipropetrovs'k, Kyiv, Zhytomyr, Lviv, and Vinnytsia regions. While in 2000, the main volumes of nuts were produced in Dnipropetrovsk, Donetsk, Lviv, Khmelnytskyi, and Chernivtsi regions, in 2023, the main producers were Cherkasy, Khmelnytskyi, Chernivtsi, Odesa, and Vinnytsia regions. Donetsk region lost its position due to the hostilities that began in 2014, while the northern and western regions strengthened their positions due to climate change (increased active temperatures and better moisture supply).

Concentration and structure of producers in fruit and berry production. The structure of main producers (enterprises and households) did not change significantly during the study period (Table 1.1). The area of plantations in enterprises decreased significantly, while households[1] retained them and even expanded them in the pre-war period. At the same time, households have consistently used plantations efficiently, which has resulted in their share in production remaining stable, while enterprises, despite a significant reduction in plantation areas, have increased productivity while maintaining their share in production. It should be noted that in the pre-war period, yields and, consequently, production volumes were increasing in both categories of farms.

Table 1.1. Dynamics of area and production of fruit and berry crops by category of farms in Ukraine

Source: compiled according to the State Statistics Service of Ukraine

Indicator	2000	2010	2015	2020	2021	2022	2023
Area under fruit and berry crops in farms of all categories, thousand ha	378.0	223.2	206.0	191.0	190.5	171.2	167.0
including:							
share of enterprises, %.	64.4	33.6	28.8	22.8	22.4	19.2	19.9
share of households, %.	35.6	66.4	71.7	77.2	77.6	80.8	80.1
Production of fruit and berry crops, thousand tons	1452.6	1746.5	2152.8	2023.9	2235.1	1994.8	1995.9
including:							
share of enterprises, %.	18.2	16.4	19.1	16.8	20.8	17.7	19.8
share of households, %.	81.8	83.6	80.9	83.2	79.2	82.3	80.2

A more detailed analysis of the producer groups shows that large enterprises are not engaged in production of fruit and berry crops, medium-sized entrepreneurs are few and far between, and their activities are not effective in the production of stone fruit and pome fruits. At the same time, there is a significant number of small enterprises whose main activity is the cultivation of pome and stone fruits, berries and nuts, and they are mainly

[1] In Ukraine category 'households' is united rural households, urban households and persons entrepreneurs working in the agriculture field.

represented by micro-enterprises[2]. The situation in 2022 was affected by military actions, which led to a decrease in the number of producers of all producer groups.

Table 1.2. Activities of fruit and berry producers - large, medium, small and micro-enterprises

Source: compiled according to the State Statistics Service of Ukraine

Indicators	2015	2020	2021	2022
growing pome fruit and stone fruits				
Quantity, units: large enterprises*	-	-	-	-
medium-sized enterprises	33	27	27	17
small enterprises	812	885	827	608
of them are micro-enterprises	751	824	770	552
Operating profitability, %: large enterprises	-	-	-	-
medium-sized enterprises	49.6	8.5	-1.1	-17.2
small enterprises	28.4	13.9	23.0	0.9
of them are micro-enterprises	15.6	19.1	17.8	4.6
growing berries, nuts, other fruit trees and shrubs				
Quantity, units: large enterprises	-	-	-	-
medium-sized enterprises	4	6	9	11
small enterprises	746	921	912	781
of them are micro-enterprises	729	893	879	753
Operating profitability, %: large enterprises	-	-	-	-
medium-sized enterprises	...**	45.3	14.2	21.8
small enterprises	...	16.6	27.4	8.5
of them are micro-enterprises	28.7	12.8	16.6	13.4

** Large enterprises did not indicate the relevant type of economic activity, so statistical data indicates that they are not interested in this sector; ** data are not disclosed in order to comply with the requirements of the Law of Ukraine "On Official Statistics" on statistical confidentiality.*

For a long time, the production of fruit and berry products has been steadily shifted from agricultural enterprises to small farms and households, and this process continues, leaving large enterprises with minimal involvement in producing such goods. This is facilitated by the existing formats of state support and the readiness of small producers to introduce new technologies on small areas. Currently, such producers of fruit and berry products dominate the domestic market and are entering foreign markets. As mentioned above, the share of household accounts for 80% of total fruit and berry production, and small and micro enterprises dominate among enterprises. They declare their interest in creating standard batches of quality products for sale in Ukraine and the EU markets[3].

1.2. Brief overview of production of apples, raspberries, strawberries, and walnuts

Apple production. Ukraine is a major player in the European apple market and enjoys a very favorable geographical location. Ukraine's annual apple production is around 1.1-1.2 million tons. At the same time, 70% of the harvest is produced by households to meet their own needs and partially for further sale to the end consumer or for processing. According to a household survey conducted by the State Statistics Service of Ukraine in 2021, the share of fruits sold by households was 18.8%, and berries - 27.3%. The rest of the apples are grown by agricultural enterprises.

Ukraine has optimal climatic conditions for growing apples throughout the country, and in the southern regions, even those with a long growing period can be cultivated. According to FAO estimates [4], annual apple consumption in Ukraine averages 16 kg per person but this figure is expected to reach the European level of 23 kg per person per year. This indicates significant potential for the domestic market.

In the recent period, due to the transition of producers to intensive apple growing technologies and optimization of the varietal structure of the orchard, yields have increased significantly and are now almost identical in enterprises and households (Figure 1.3).

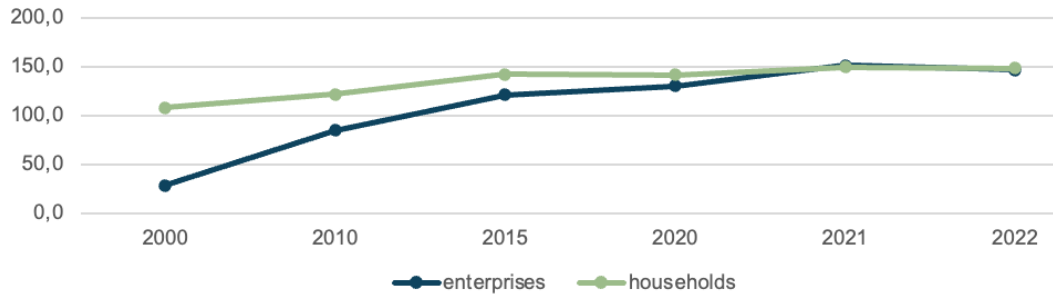
[2] Micro-enterprises are individuals and legal entities with an average number of employees for the reporting period (calendar year) not exceeding 10 persons and annual income from any activity not exceeding the equivalent of EUR 2 million. Small business entities are individuals and legal entities with an average number of employees for the reporting period (calendar year) not exceeding 50 people and annual income from any activity not exceeding the equivalent of EUR 10 million. Large enterprises are legal entities with an average number of employees exceeding 250 in the reporting period (calendar year) and annual income from any activity exceeding the equivalent of EUR 50 million, determined at the average annual exchange rate of the National Bank of Ukraine. Medium-sized enterprises are other business entities.

[3] Ukrainian Berries Association. https://uaberries.com/en/about-association

[4] Food Balances. FAOSTAT. https://www.fao.org/faostat/en/#data/FBS

Fig. 1.3. Dynamics of apple yields, centners per hectare

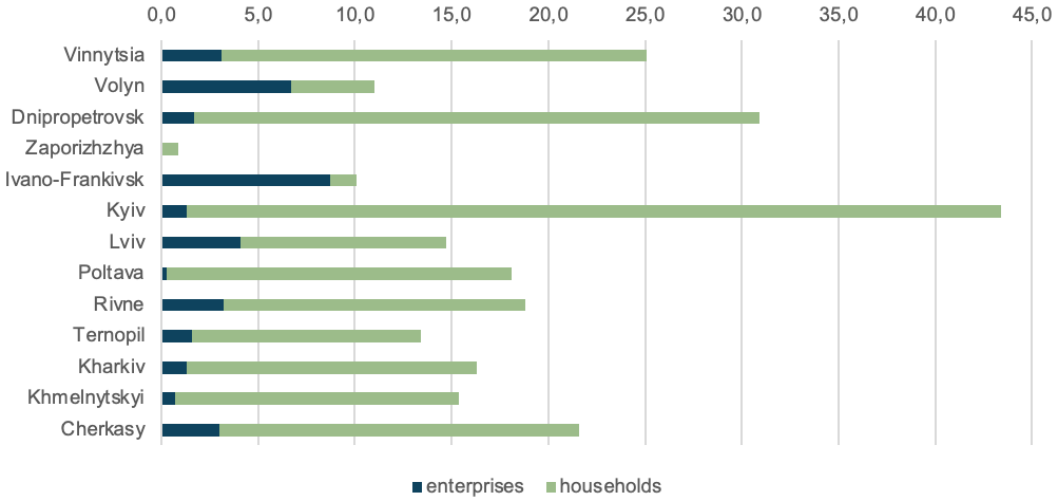
Source: based on data from the State Statistics Service of Ukraine



One of the most important regions in apple production is Vinnytsia (Figure 1.4). Vinnytsia region accounts for about 30% of the total apple harvest in the study areas and has the highest production rate in Ukraine due to the large production areas of 100 to 400 ha across the region.

Fig. 1.4. Area of apple plantations at bearing age in 2023, thousand hectares

Source: based on data from the State Statistics Service of Ukraine[5]



Apple orchards require serious investment, and profit is delayed in time, as achievement of full productivity begins 4-5 years after planting. Thus, it will take a long time to reach self-sufficiency and receive the first profits. Old orchards lose their productivity over time, so they need to be reconstructed in time, cutting down old trees and planting new ones. Therefore, without a state budget programme, rejuvenation of apple orchards is a challenging task.

At the same time, there are currently favorable economic conditions for the development of apple growers. According to experts, due to liberal tax policy, a favorable support system, and relatively cheap labor, as well as high market demand, their number will grow in the coming years, even in the face of war[6].

Production of garden strawberries. Since the outbreak of the war, berry growing in Ukraine has been gradually regaining its position, owing to new regions and new grant programmes. Traditionally, garden strawberries dominate the Ukrainian berry market in terms of production and consumption. Raspberries are in second place, and blueberries are in third. This was the case before the occupation of the south of Ukraine. Approximately 40% of the country's wild strawberries were grown in the temporarily occupied Kherson region and other regions of the south of Ukraine. During the war, many farmers in government-controlled areas started growing garden strawberries. However, the Ukrainian Fruit and Vegetable Association believes that the actual increase in strawberry cultivation might not be accurately shown in the official data.

According to the State Statistics Service of Ukraine, from 2020 to 2023, the area under garden strawberries in Ukraine decreased from 8.6 to 7.1 thousand hectares. The reasons for this decrease include military operations and the lack of certified seedlings of our production, as there are practically no official garden strawberry nurseries left in the country: some have closed, and others remain in the temporarily occupied territory. As a result, the gross harvest of garden strawberries decreased from 62.3 thousand tons

[5] Built based on data excluding the territories temporarily occupied by the Russian Federation and part of the territories where military operations are (were) conducted. Data for several regions are not made public to comply with the requirements of the Law of Ukraine "On Official Statistics" to ensure the guarantees of statistical confidentiality of state statistics bodies. Therefore, there is no data for six regions, where the area of plantations is 6.5% of the total.

[6] Varietal trends and prospects of the apple market in Ukraine [in Ukrainian]. https://hopu.com.ua/uk/sortovi-trendy-ta-perspektyvy-rynku-yabluk-v-ukrayini/.

in 2021 to 53.4 thousand tons in 2023, which means that there is a downward trend in berry production in the country. In 2021, the yield was 77.3 centners per hectare, in 2022 it dropped to 74.8 centners per hectare, and in 2023 it started to grow again - 76.7 centners per hectare.

In Ukraine, 90% of garden strawberries are grown in households. In 2023, the largest amount of garden strawberries was grown in Zhytomyr, Kyiv, Dnipro, Volyn, and Lviv regions (Fig. 1.5). In total, the producers of these regions generated 44% of the Ukrainian gross harvest of garden strawberries. Figure 1.5 does not include Zhytomyr region, which is currently the largest producer. This is due to the lack of separate data for enterprises and households because of the presence of several large enterprises that form the entire production volume[7].

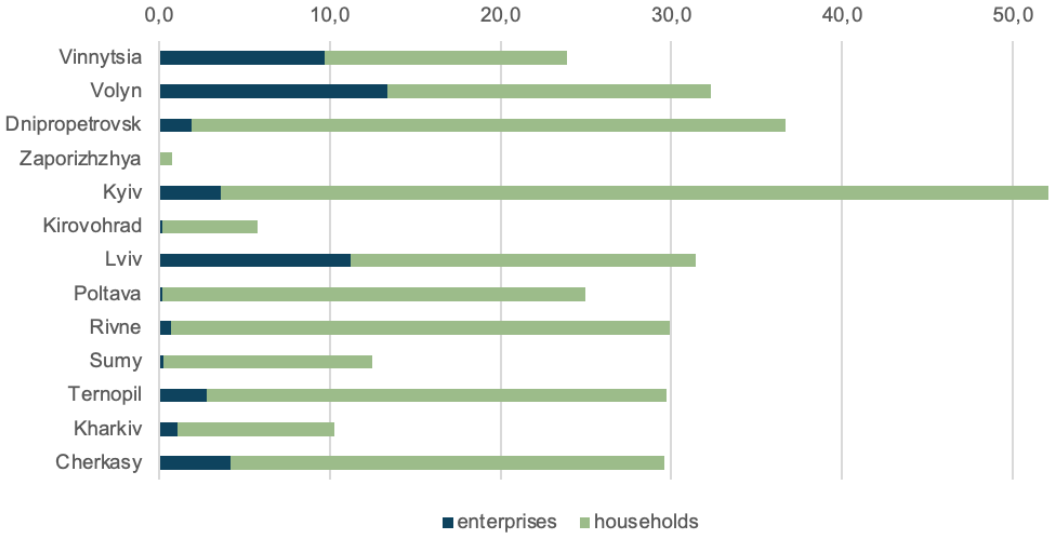


Fig. 1.5. Production of garden strawberries in 2023, thousand centners

Source: based on data from the State Statistics Service of Ukraine

Raspberry production. Despite a full-scale war in Ukraine for more than two years, pessimistic forecasts for early 2022, and an unstable situation in the country, some areas of the agricultural sector continue to develop. First and foremost, this applies to the Ukrainian berry industry, which demonstrates not only an increase in planted areas but also an increase in gross berry production. From 2011 to 2021, the area under raspberries increased by 6%, while the area under strawberries, gooseberries, and currants decreased. Raspberries have been leading the way in terms of area expansion in the structure of berry plantations. The rapid growth in raspberry production was caused by several reasons, including the following: the creation of raspberry plantations requires significantly less investment than, for example, blueberries; raspberries reach commercial fruiting much faster; farmers believe that the technology for growing this crop is much simpler than others; very high raspberry prices over the past 2-3 years, which has led many small and medium-sized enterprises to plant raspberries.

According to the State Statistics Service, as of 2023, raspberries and blackberries grow in Ukraine on an area of 4.6 thousand hectares (enterprises and households), and the gross harvest from the total planted area was 33.5 thousand tons. At the same time, according to the Ukrainian Fruit and Vegetable Association (UHA), the gross production of raspberries in 2023 was much higher and reached 60-65 thousand tons[8].

The dynamics of raspberry yields are quite positive. In enterprises, the yield increased from 15.3 c/ha in 2011 to 44.0 c/ha in 2023, and in households - from 57.9 c/ha to 80.5 c/ha and remains significantly better than in enterprises (in 2023, it was 1.8 times higher).

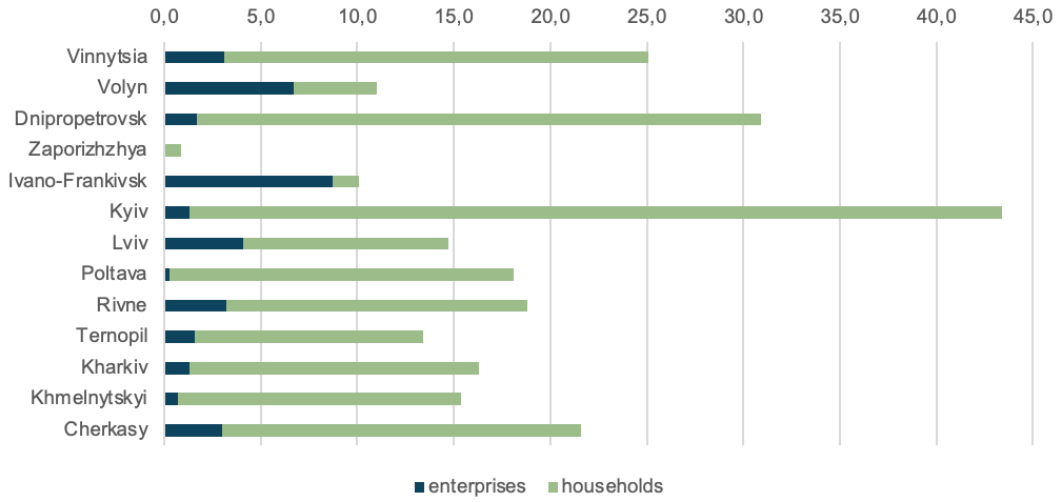
[7] Built based on data excluding the territories temporarily occupied by the Russian Federation and part of the territories where military operations are (were) conducted. Data for several regions are not made public in order to comply with the requirements of the Law of Ukraine "On Official Statistics" to ensure the guarantees of statistical confidentiality of state statistics bodies. Therefore, there is no data for six regions.

[8] Oksana Marchuk. Raspberries, blackberries and currants: what is the situation on the berry market? Yahidnyk. December 2023. pp. 18-20.

[9] Built based on available data excluding the territories temporarily occupied by the Russian Federation and part of the territories where military operations are (were) conducted. Data for several regions are not made public in order to comply with the requirements of the Law of Ukraine "On Official Statistics" to ensure the guarantees of statistical confidentiality of state statistics bodies. Therefore, there is no data for 11 regions that produce almost 30% of all volumes.

Fig. 1.6. Production of raspberries and blackberries in 2023, thousand centners

Source: based on data from the State Statistics Service of Ukraine



Raspberry yields are influenced by both varieties and cultivation techniques. As for the raspberry varieties grown in Ukraine, a distinction should be made between professional berry growers and households. Thus, small farms often grow raspberries of unknown reproduction. The UHA believes that these are Polka and Polana, which are good Polish varieties, but with low quality planting material due to uncontrolled reproduction[10]. At the same time, professional raspberry growers in Ukraine mainly grow remontant varieties with high quality planting material.

In Ukraine, 89% of raspberries are grown in households. In 2023, most raspberries were grown in Kyiv, Dnipro, Vinnytsia, Cherkasy, and Rivne regions. Together, producers in these regions account for 42% of Ukraine's gross raspberry harvest.

Unlike widespread grains and oilseeds, raspberry production is much more dependent on the skills of specialists, weather conditions, and material costs per hectare are much higher than for growing grain and oilseeds, and more operations per hectare are required. The business is planned for many years and exiting it can result in a complete loss of investment, whereas in cereals, you can change the crop or variety for the next year of production. Growing raspberries requires many seasonal workers (3 to 5 per hectare). However, given the constant expansion of raspberry production areas, it is still profitable to invest in raspberry cultivation in Ukraine, but only if you have a clear understanding of the strategy for such investments.

In Ukraine, the processing of grown berries is not sufficiently developed. The berries are mostly frozen and shipped to other countries, where they are further processed, and more value is added. But at the same time, we see that Ukraine remains a reliable supplier of high-quality and safe berries to international markets, especially organic ones. Even during the war, exports of Ukrainian products continued to grow, demonstrating the flexibility and resilience of the berry sector[11].

According to experts, Ukraine has all the conditions to become a regional center for nursery farming, where seedlings with international certification will be grown for its own needs and for the markets of Central Asia and other regions where it is difficult and expensive to produce planting material[12].

Production of walnuts. Walnut is the only nut that is grown in all regions of the world. It can also be grown throughout Ukraine, but conditions are particularly favorable in the southern and south western regions. Ukrainian walnut varieties are the most winter-hardy in the world due to natural and human selection. Ukraine's walnut production has been growing steadily and has doubled since 2000, reaching 115.5 thousand tons in the pre-war period. The war had a negative impact on walnut production due to the loss of territory, damage to plantations, and difficulties with resources and logistics.

According to the FAO, China was the world's largest producer of walnuts in the shell in 2022 (1400 thousand tons), followed by the USA (682.2 thousand tons), and Iran (355 thousand tons)[13]. Turkey, Mexico, Chile, and Burkina Faso took the next places, and respectively, Ukraine was ranked 8th in the ranking.

[10] Oksana Marchuk. Raspberries, blackberries and currants: what is the situation on the berry market? Yahidnyk. December 2023. p. 19.

[11] Infographics. OrganicInfo.ua URL: https://organicinfo.ua/en/

[12] Garden strawberries: what's trending? Yagidnyk. http://www.jagodnik.info/sunytsya-sadova-shho-v-trendi/

[13] Countries by commodity. FAOSTAT. https://www.fao.org/faostat/en/#rankings/countries_by_commodity

A significant advantage of Ukraine is its proximity to Europe, one of the largest consumers of nuts, which is convenient for export. This allows Ukraine to supply products quickly and ensure the sustainability of transportation. The main suppliers of walnuts to the European market - the United States, Chile, Argentina, and Australia[14] - enter the market at a season different from Ukraine. Walnuts from the United States, harvested between mid-September and November, are exported starting in November. Meanwhile, Southern Hemisphere countries ship their walnuts in the spring, avoiding overlap with Ukraine's early fall exports [15]. This is important in terms of the seasonality of production and may also be an advantage for Ukrainian walnut producers in the future.

In the structure of fruit and berry crops in Ukraine, nuts rank last in terms of both planted area - 8.5% (14.2 thousand hectares) in 2023 - and gross harvest - 5.4%, although this share is constantly growing despite the war and economic difficulties. Walnuts dominate nut production, making up 99% of the total output. Almost all walnut plantations are concentrated in households, producing 97% of the total volume. Since the main producers are households, there are problems with the use of proper harvest processing technologies and the presence of a significant share of defective products (according to experts, it is estimated to be between 10 and 20% of the harvest)[16]. Sometimes, the fruit is peeled and split manually.

In recent years, the zonal distribution of walnut plantations in Ukraine has been affected by the hostilities and the occupation of part of the territory. Currently, they are concentrated mainly in Vinnytsia, Chernivtsi, Dnipro, Lviv, Zakarpattia, Khmelnytskyi, and Cherkasy regions (61% of all plantations in fruiting age). The gross harvest is formed somewhat due to different yields - most of all in Cherkasy, Khmelnytskyi, Chernivtsi, Vinnytsia, and Dnipro regions (44%) (Fig. 1.7). In 2023, Ukraine produced 106.1 thousand tons of walnuts, which is 8% lower than in the pre-war year of 2021.

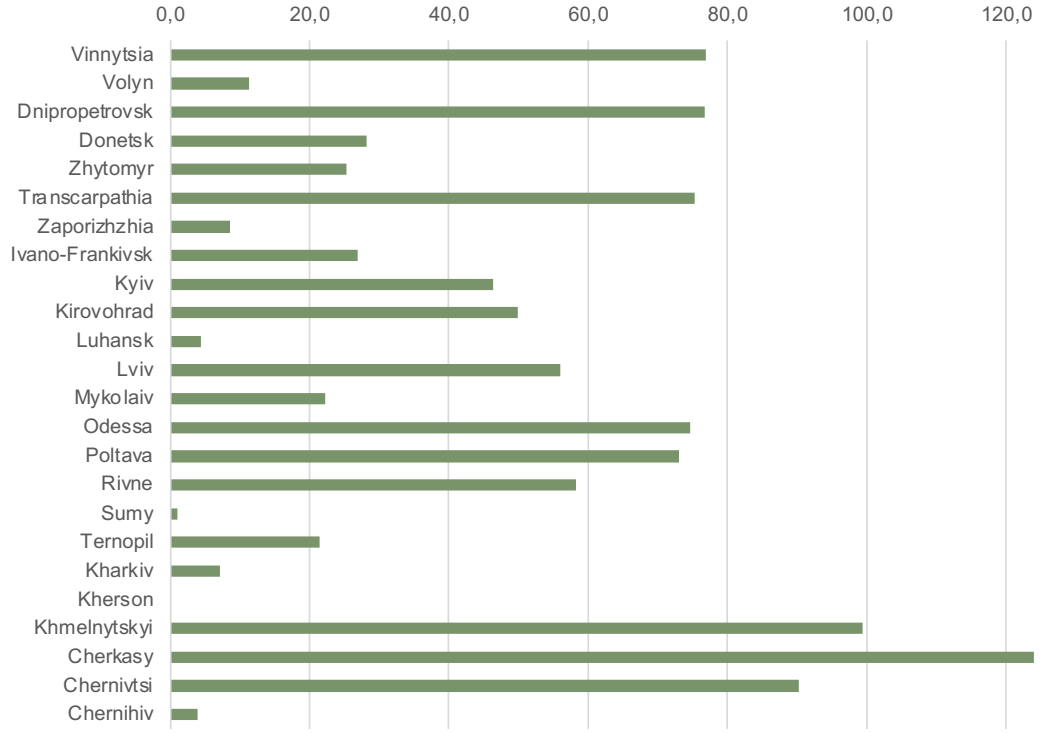


Fig. 1.7. Production of walnuts in 2023, thousand centners

Source: based on data from the State Statistics Service of Ukraine

The area of walnut orchards in Ukraine varies from 4 to 20 hectares, but there are also 50-70 hectares. Nut plantations are often concentrated on family shares. In 2023, the area of fruiting plantations increased by 700 hectares in enterprises. The increased planting of walnuts by entrepreneurs is explained by the increased attention of business structures to walnut growing in recent years.

Analysis of the walnut market shows positive prospects for the industry's development in the future. Ukraine has favorable natural conditions for growing walnuts and, even with minimal investment, is a global leader in production and exports.

[14] European Union Walnuts in shell, fresh or dried imports by country in 2023. WITS. https://wits.worldbank.org/trade/comtrade/en/country/EUN/year/2023/tradeflow/Imports/partner/ALL/product/080231

[15] Ukrainians can sell walnuts to Europe at an attractive price [in Ukrainian]. ArgoTer. https://agroter.com.ua/2021/09/01/ukrayinczi-mozhut-prodavaty-yevropi-voloski-gorihy-za-pryvablyvoyu-czinoyu/?utm_source=chatgpt.com#

[16] The market of nuts: sales geography, exporters and production. Kurkul. https://kurkul.com/spetsproekty/1215-rinok-gorihiv-geografiya-prodajiv-eksporteri-i-virobnitstvo

1.3. Brief overview of exports of fruits, berries and walnuts

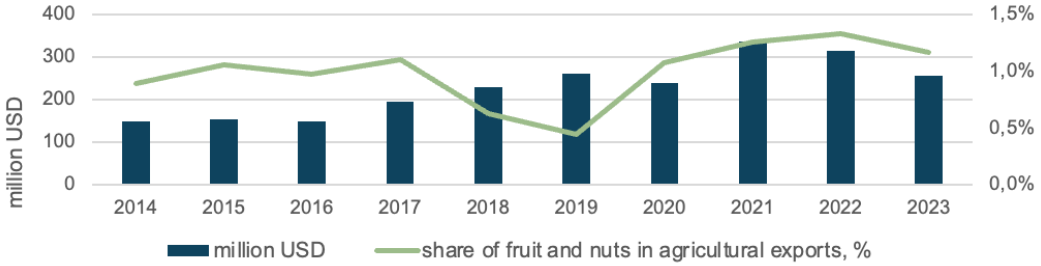
a) Exports of fruits, berries and walnuts

Place of exports of fruits, berries and nuts in agricultural exports

In recent years, the export of fruits, berries and nuts has been actively developing in Ukraine (HS 08 Fruit and nuts, edible; peel of citrus fruit or melons). In 2021, the export of fruits, berries and nuts from Ukraine amounted to 336 million USD, which is more than double the export in 2014 (Fig. 1.8). Even in the first year of full-scale war (2022), exports of fruits, berries, and nuts were only 6.6% lower than in 2021. However, in 2023, exports of fruits, berries, and nuts were 23.6% less than in 2021. This is explained by complicated export logistics at the borders with neighboring EU countries.

Fig.1.8. Ukraine's fruit and nuts exports, 2014-2023.

Data source: UN Comtrade data base. https://comtradeplus.un.org/



Despite the dynamic development of exports of fruits, berries, and nuts, their share in agricultural exports of Ukraine (01-24 HS Chapters) does not exceed 1.4%. However, the export of fruits, berries and nuts is quite important for Ukraine in terms of:

- involvement of small and medium-sized businesses in export,
- leading positions of Ukraine in the world market of nuts without shell (Fig.1.15),
- predominant focus on EU markets (Table 1.3),
- leading positions of Ukrainian frozen raspberries on the EU market (Table 1.3).

Table 1.3. Value chains of fruits, berries, and nuts in the export of Ukraine, including to the EU (products in focus), 2023

Data source: UN Comtrade data base. https://comtradeplus.un.org/; An official website of the European Union. Access2Markets. https://trade.ec.europa.eu/access-to-markets/en/statistics

Commodity	Exports from Ukraine, thousand tons	Exports from Ukraine to the EU, thousand tons	EU share in exports from Ukraine, %	Share of Ukraine in imports to the EU, %	Top 3 importing countries	Top 3 importers among EU countries
Apples HS 080810	41.90	6.00	14.40%	2.20%	Arab Emirates, Turkey, Austria	Austria, Sweden, France
Apple juice HS 200971, HS 200979	91.64	54.60	59.58%	6.26%	USA, Poland, Germany	Poland, Germany, Austria
Strawberry HS 081010	0.13	0.10	76.92%	0.43%	Poland, Moldova	Poland
Fresh raspberry HS 08102010	0.56	0.38	67.86%	0.33%	Poland, the Netherlands	Poland, the Netherlands
Frozen raspberry HS 0811203100	45.63	42.40	92.91%	53.91%	Poland, Germany, the Czech Republic	Poland, Germany, the Czech Republic
Walnuts in shell HS 08231	8.58	0.56	6.53%	1.40%	Iraq, Turkey, Azerbaijan	Bulgaria, Italy, Germany
Walnuts shelled HS 08232	22.03	12.80	58.10%	36.47%	Azerbaijan, Turkey, Romania	Romania, France, Czech Republic

Ukraine is the fourth exporter of walnuts without shells (HS 080232 Nuts, edible; walnuts, fresh or dried, shelled) in the world, after the USA, China, and Mexico, with a share of the world market of 6.1%. and export volumes of 22.03 thousand tons (2023).

In 2023, the export of fruits, berries, and nuts from Ukraine to the EU amounted to 199 million US dollars, i.e., 77.6% of all exports of these goods from Ukraine. 24% of fruits, berries, and nuts are exported to Poland, 9.3% to Germany, and 5% each to Italy, France, the Czech Republic, and Romania (2023).

Also, the share of Ukrainian raspberries in raspberry imports to the EU exceeds 50% (54% in 2023).

Fresh raspberries (HS 08102010)

Ukraine exports small amounts of fresh raspberries. Exports are carried out exclusively to the EU (2023). In 2023, about 400 tons of fresh raspberries were exported (Fig. 1.9). The largest importer of fresh raspberries from Ukraine among the EU countries is Poland. In 2021, raspberries were delivered to Germany, and in 2019 and 2020 - to Romania and Slovakia.

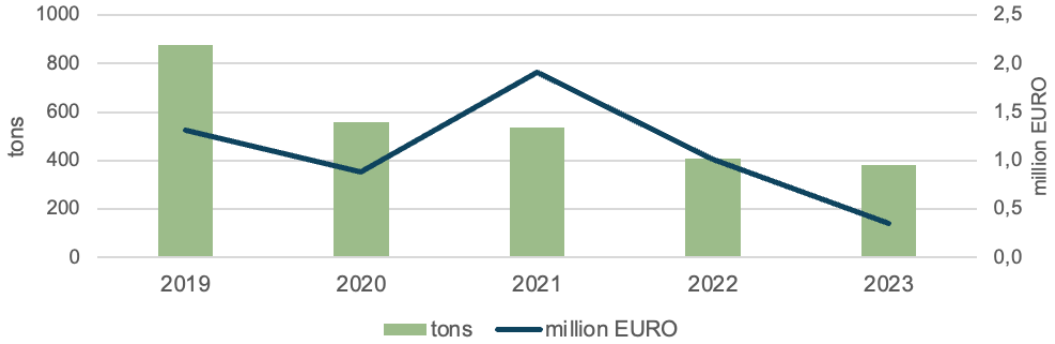


Fig. 1.9. Ukraine's exports of the fresh raspberry (HS 08102010) to the EU, 2019-2023

Data source: An official website of the European Union. Access2Markets. https://trade.ec.europa.eu/access-to-markets/en/statistics.

Frozen raspberries (HS 0811203100)

Raspberries are mainly exported in frozen form. In 2023, Ukraine exported 45.6 thousand tons of frozen raspberries (Fig. 1.10). Most raspberries were exported to Poland, Germany, and the Czech Republic. In 2023, 42.4 thousand tons of frozen raspberries were exported to the EU, which is 93% of Ukraine's exports. In addition to the EU, frozen raspberries are exported to the United Kingdom, the USA, Canada, Switzerland, and the Republic of Moldova.

The share of Ukraine in the import of frozen raspberries to the EU in 2023 reached 53.91%.

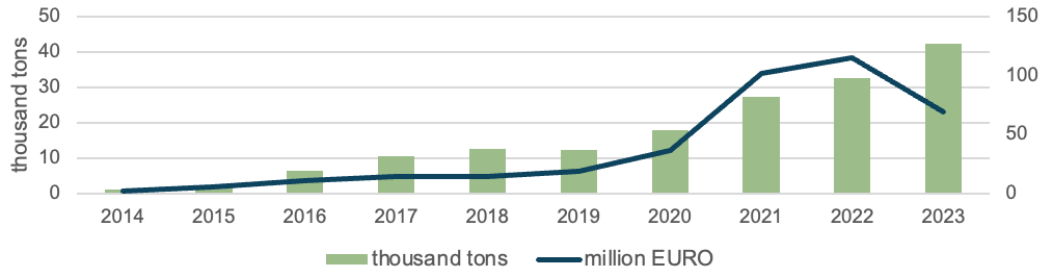


Fig. 1.10. Ukraine's exports of the frozen raspberry (HS 08112031) to the EU, 2019-2023.

Data source:
An official website of the European Union. Access2Markets. https://trade.ec.europa.eu/access-to-markets/en/statistics.

Strawberry (HS 081010)

Although the production of strawberries in Ukraine is focused mainly on domestic consumption, small volumes are exported to neighboring countries - mainly to Poland and minor volumes to Moldova.

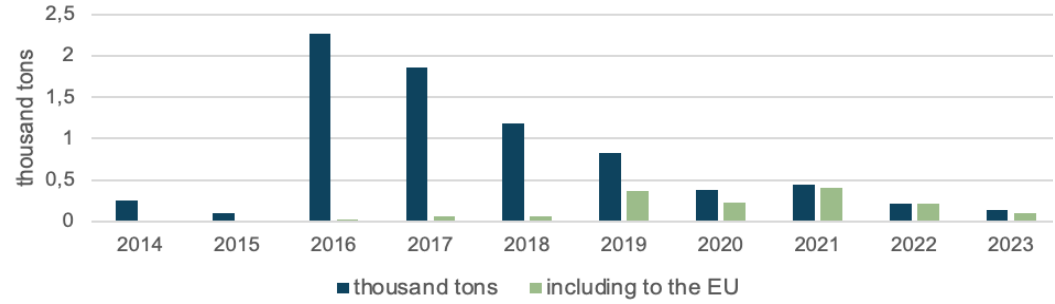


Fig. 1.11. Ukraine's exports of strawberry (HS 081010), 2019-2023.

Data source:
UN Comtrade data base. https://comtradeplus.un.org; An official website of the European Union. Access2Markets. https://trade.ec.europa.eu/access-to-markets/en/statistics

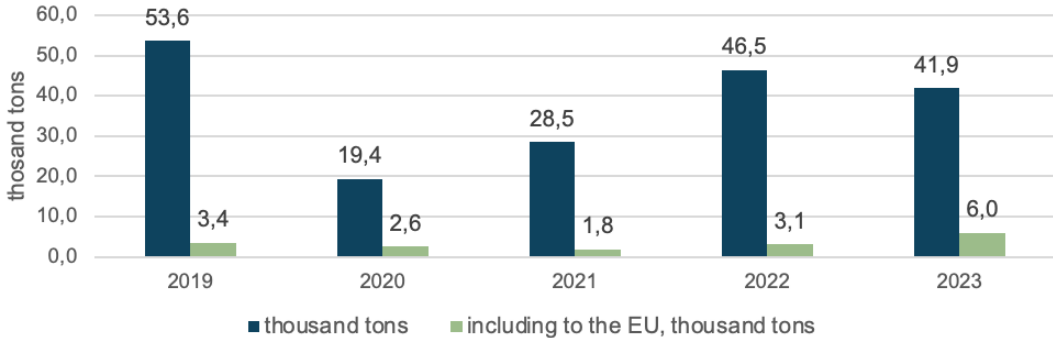
Despite the general trend of decreasing export volumes of fresh strawberries, which has been ongoing since 2017 (Fig. 1.11), exports to the EU increased until 2021. In 2023, exports to the EU decreased to 100 tons, which is explained by the complicated logistics of exporting perishable goods.

Apples (HS 080810)

Ukraine exports fresh apples to more than 60 countries of the world; the volume of exports in 2023 was about 50,000 tons. Although less than 15% of domestic apple exports are exported to the EU, exports to the EU are constantly growing and reached 6,000 tons in 2023 (Fig. 1.12).

Fig. 1.12. Ukraine's exports of fresh apples (HS 080810), 2019-2023.

Data source: UN Comtrade data base. https://comtradeplus.un.org/; An official website of the European Union. Access2Markets. https://trade.ec.europa.eu/access-to-markets/en/statistics.



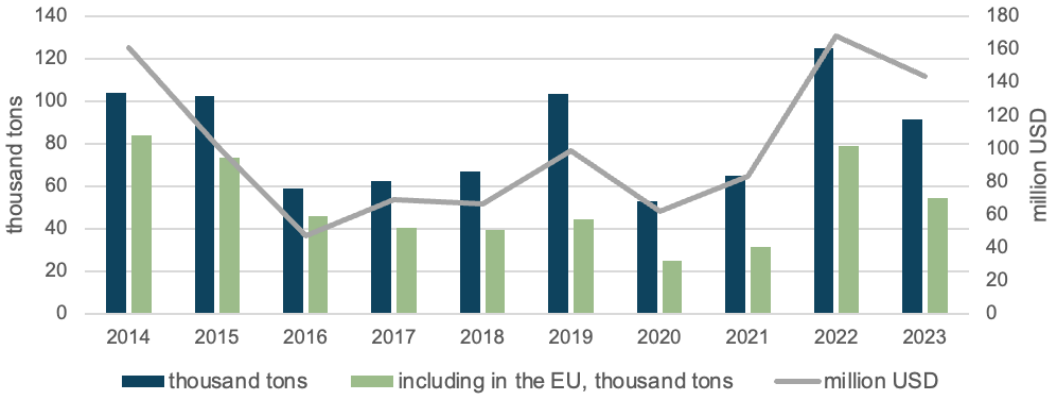
The top three importers of Ukrainian apples include the United Arab Emirates, Turkey, and Austria (2023). The top three importers of Ukrainian apples in the EU include Austria, Sweden, and France (2023).

Apple juice (HS 200971, HS 200979)

Ukraine exports apple juice in much larger volumes than fresh apples. About 60% of Ukrainian exports are to the EU (2023). In 2022, the export of apple juice from Ukraine to the EU increased by 2.5 times compared to the volume of the previous year 2021 (Fig. 1.13). The sharp increase in the export of apple juice from Ukraine in 2022 was influenced by the introduction of autonomous trade preferences by the EU, which abolished import tariff quotas for apple juice. In 2023, the export of apple juice from Ukraine to the EU decreased by 31% from the level of 2022, which is explained by logistical difficulties at the borders of neighboring EU countries.

Fig. 1.13. Ukraine's exports of apple juice (HS 200971; HS 200979), 2014-2023.

Data source: UN Comtrade data base. https://comtradeplus.un.org/; An official website of the European Union. Access2Markets. https://trade.ec.europa.eu/access-to-markets/en/statistics.



Ukraine exports the largest volumes of apple juice to the USA, Poland, and Germany, and among the EU countries, the top 3 importers of Ukrainian apple juice include Poland, Germany, and Austria.

Walnuts (HS 080231 – in shell, HS 080232 – shelled)

The export of walnuts from Ukraine is consistently high, although the war in Ukraine has reduced its volumes. (Fig. 1.14). In 2022, the export of walnuts in shell decreased by 31%, but already in 2023, it recovered and exceeded the pre-war level by 12%. Similar trends in the development of the export of walnuts without shell - a decrease of 28% in 2022 and an increase of 21% in 2023 compared to the level of 2021.

More nuts are exported without the shell than in the shell. Ukraine is the world's fourth exporter of shelled walnuts after the USA, China, and Mexico, with a world market share of 6.1% and export volumes of 22.03 thousand tons (2023). Most nuts without shell are exported (in 2023) to Azerbaijan, Turkey, Romania, and France, and in shell to Iraq, Turkey, and Azerbaijan.

On the EU market, Ukraine's biggest competitor is Germany, which is among the top 5 world exporters of walnuts without shells, with an export volume of 16.8 thousand tons. To the EU, Ukraine mainly exports walnuts without shells (Fig. 1.15). The share of Ukraine in the import of walnuts to the EU is quite significant: 36.5% for nuts without shells. In 2023, 41.8% of walnuts were exported by Ukraine to the EU, mostly to Romania, France, and the Czech Republic.

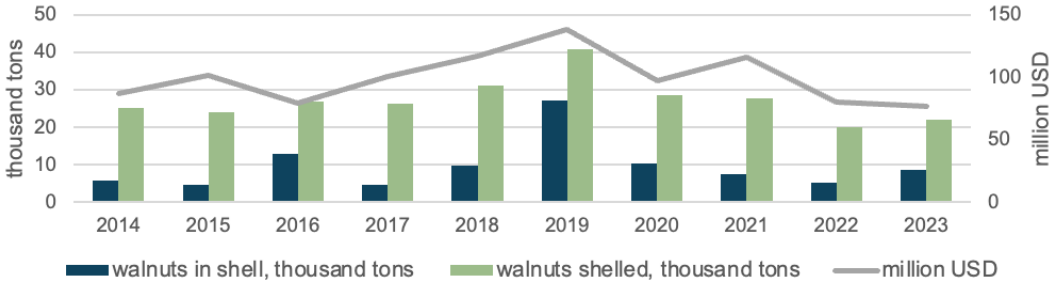


Fig. 1.14. Ukraine's exports of walnuts (HS 080231, HS 080232), 2014-2023.

Data source:
UN Comtrade data base.
https://comtradeplus.un.org/

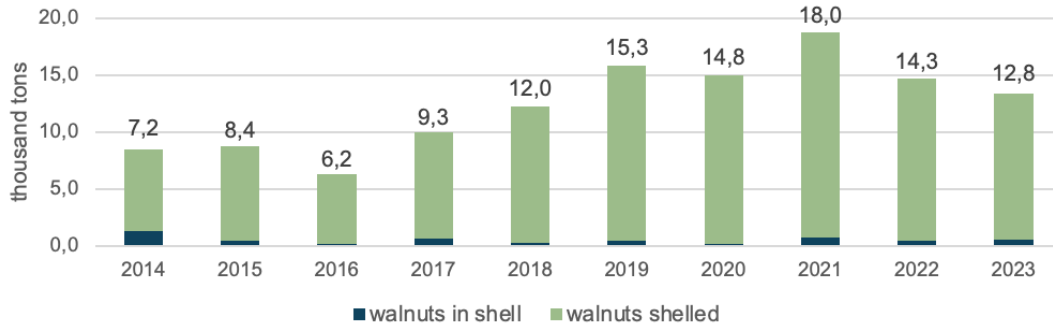


Fig. 1.15. Ukraine's exports of walnuts (HS 080231, HS 080232) to the EU, 2014-2023.

Data source:
UN Comtrade data base.
https://comtradeplus.un.org/;
An official website of the European Union. Access2Markets. https://trade.ec.europa.eu/access-to-markets/en/statistics

b) Government measures to increase exports (including to the EU)

The main measures to support the export of agricultural products of Ukraine are defined in the "Strategy for the development of the export of products of agriculture, food and processing industry of Ukraine until 2026" (as amended from 12.05.2023)[17]. This document is one of the six sectoral export strategies developed in accordance with the provisions of the Export Strategy of Ukraine for the period 2017-2021, the final goal and main task of which is the transition to the export of scientific and innovative products. The Strategy for the development of the export of products of agriculture, food and processing industry of Ukraine until 2026 sets three main goals: 1) increasing the competitiveness of products and expanding the product range of exports; 2) diversification of sales markets; 3) promotion of the Ukrainian brand and information and analytical support for the export of agricultural, food and processing industry products.

To implement the Export Strategy, the Council for International Trade was created under the Cabinet of Ministers of Ukraine, which is headed by the First Vice Prime Minister of Ukraine - the Minister of Economy of Ukraine. The Working Group on Export Promotion, headed by the Deputy Minister of Economy of Ukraine - Trade Representative of Ukraine, works as part of the Council for International Trade.

Also, to implement the Export Strategy of Ukraine, the Ministry of Economic Development and Trade of Ukraine created a consultative and advisory body, the Export Promotion Office (EPO), which works as a "single window" to help Ukrainian exporters to enter new markets. EPO carries out measures aimed at the development of export competencies of Ukrainian business, assistance in establishing cooperation and partnership between Ukrainian and foreign businesses, and promotion of Ukrainian goods and services abroad.

The Ministry of Economy of Ukraine, together with leading international expert organizations, started work on updating the Export Strategy of Ukraine in wartime and post-war recovery. In the updated Export Strategy of Ukraine, it is planned to consider changes in the structure of the Ukrainian economy, prospects for post-war recovery of the country, redistribution of export markets, reorientation to new regions and specific countries, as well as adaptation of Ukrainian production to the standards and needs of EU consumers.

With the beginning of a full-scale war, the Government of Ukraine, together with international partners, is taking measures to restore agricultural exports by sea, river, and land routes.

The restoration of agro-food exports in war conditions is taking place in the following directions:

- Creation of special routes for Ukrainian goods, so-called Solidarity Lanes, on the initiative and with the help of EU governments, which allowed Ukraine to export food

[17] Decree of the Cabinet of Ministers of Ukraine dated July 10, 2019 No. 388-r "On the approval of the Strategy for the development of exports of agricultural products, food and processing industry of Ukraine for the period until 2026".https://zakon.rada.gov.ua/laws/show/588-2019-%D1%80#Text

by rail, road and river transport through the ports of the Baltic Sea - Gdansk and Gdynia in Poland, Klaipeda in Lithuania, Constanta in Romania. The development of solidarity lanes involves: (1) additional cargo rolling stock, ships and trucks (2) increasing the capacity of transport networks and transshipment terminals due to the priority of export transportation of Ukrainian agricultural products and the urgent movement of mobile grain loaders to the appropriate border terminals to speed up transshipment, (3) acceleration of customs operations and other inspections and (4) provision of storage facilities for product storage in the EU.

- Restoration of maritime transportation through (1) concluding an agreement on the opening of a safe maritime humanitarian corridor in the Black Sea, mediated by the UN and Turkey (valid from August 1, 2022 to July 17, 2023); (2) export via sea routes under the control of the Navy Armed Forces of Ukraine after the termination of the Black Sea Grain Initiative, while the port infrastructure suffers from regular Russian missile attacks.
- Development of new export routes through Danube ports through the implementation of large-scale Danube shipping projects.

b) State support for export

The Law of Ukraine "On Financial Mechanisms for Stimulating Export Activity" (current version dated January 1, 2024)[18] determines measures of state support for export activities: insurance, reinsurance, guarantees, and partial compensation of the interest rate on export loans. To support the export of goods (works, services) of Ukrainian origin, in accordance with the Law, the Export Credit Agency (ECA) was established. Article 8 of the Law of Ukraine "On Financial Mechanisms for Stimulating Export Activity" defines the spheres of activity of the Law and contains exceptions to which state export support does not apply. Among them are product groups 0801-0813, which include fresh, dry, and frozen fruits, berries and nuts. The export of apple juice is not excluded from the scope of services provided by ECA.

Recommendations regarding state support for the export of berries, fruits, and nuts under conditions of climate change:

- *Amend the Law of Ukraine "On Financial Mechanisms for Stimulating Export Activity" by excluding the goods of the Section HS 08 from the list of goods whose export is not supported by the ECA. Export credit agencies of EU countries give preference to supporting small and medium-sized businesses, which include producers of berries, fruits and nuts.*
- *Develop a new Strategy for the development of the export of products of agriculture, food and processing industry of Ukraine until 2030 (after the adoption of the updated Export Strategy of Ukraine), in which measures will be prescribed to adapt agricultural exports to changes in agro-climatic conditions.*

1.4. Brief overview of processing fruits, berries and nuts

Technologies. Fruit, berry and nut processing technologies can be divided into two groups: primary processing and deep processing.

Primary processing of fruits and berries involves the following operations: drying, freezing, freeze-drying (both freezing and drying), etc. As a result of primary processing, fruits and berries retain their shape and consumer characteristics. At the same time, they are transformed into a state suitable for long-term storage, transportation, further in-depth processing or fresh sale.

In the process of deep processing, fruits and berries lose their original form, are exposed to mechanical, chemical and microbiological processes, and are mixed with other ingredients in accordance with the technology of production of a particular product. In the process of deep processing, fruits and berries are used to produce juices, smoothies, jams, preserves, puree, chips, jellies, syrups, powders, pastes, natural flavors, confectionery fillings, fillers, pectin, etc. These products are partly consumed by households and partly used by dairy, bakery, confectionery, winemaking, restaurant and other businesses.

Fruits and berries, compared to other agricultural crops, have the shortest shelf life before

[18] The Law of Ukraine "On financial mechanisms for stimulating export activity" No. 1792-VIII of December 20, 2016. https://zakon.rada.gov.ua/laws/show/1792-19/conv#n161

being sold or preserved. In particular, berries can be stored from 2 hours to 2 days after harvesting, after which they lose their presentation, weight, and consume properties[19]. Unlike berries, apples have a longer shelf life when fresh. At a temperature of -2°C to +3°C, apples of winter varieties are stored for 3- 8 months, medium-ripening apples - 1-3 months, and summer-ripening apples - 15- 20 days[20].

After harvesting, strawberries and raspberries are cleaned, washed, cooled, frozen or, freeze-dried. For freezing, the company uses IQF (individual quick freezing) technology, which allows the berries to be sorted after freezing. Companies involved in shock freezing use modern imported equipment, in particular from the Polish company Unidex and the Swedish company OctoFrost Group. They also use machines for pitting, washing, cutting, freezing, etc.

The main share of nut production in Ukraine is walnuts (98%)[21]. The rest is accounted for by hazelnuts and almonds. The harvested walnuts are subjected to primary processing: they are peeled from the green shell and dried in the sun or in drying chambers. The moisture content of dried nuts should not exceed 10%. In this state, walnuts can be stored in their shells at a temperature of 5- 15°C for up to two years. In addition to peeling and drying, the primary processing of walnuts includes removing the kernel (hulling), crushing the kernel into halves, quarters, and smaller fractions, and crushing the shell.

Walnut processing products include walnut oil, paste, milk, and jam. Walnut oil is used to extract valuable aromatic compounds for the cosmetics industry: rose, violet, and citron essential oils. Jam is made from unripe walnut fruits. Walnut shells are used in the production of activated carbon, abrasives, linoleum, roofing felt, etc. For the confectionery industry, hazelnuts are blanched by roasting or steaming.

Processors. Both small and medium-sized and large enterprises process fruits, berries, and nuts. A certain number of enterprises that grow berries also freeze or sublimate their products. According to estimates, approximately 15% of the members of the Ukrainian Berry Association have quick freezing equipment. In addition to their own raw materials, medium and large enterprises purchase berries from small producers (farmers, households) who do not have processing capacity. They also provide freezing services to small enterprises: laboratory analysis of incoming raw materials, cleaning, freezing, sorting with an optical sorter, storage (-20°C) of frozen products in a refrigerator, etc.

Processing companies differ significantly in terms of the range of processed products. While small enterprises mainly freeze berries of their own production, some medium and large producers freeze seafood, vegetables, mushrooms, corn, etc., in addition to fruits and berries. Apart from canned fruit and berries, canneries also produce a wide range of canned vegetables and meat, as well as concentrates of first and second courses, drinks, etc.

According to the Ukrainian Berry Association, the largest fruit, berry and vegetable freezing companies in 2023 were: 1) Tevitta Trading (27.5 thousand tons); 2) Eco Berry (10.0 thousand tons); 3) Yarofruit (8.0 thousand tons); 4) Alte Foods (3.0 thousand tons); 5) Amethyst-Ole (2.5 thousand tons)[22].

Tevitta Trading, a part of the LNZ Group agricultural holding, is located in Shpola, Cherkasy region. The company produces frozen fruits, vegetables, berries, and nuts (including frozen strawberries and raspberries) under the Tevitta brand. The raw materials are frozen using the IQF shock freezing method at the plant, which was built in 2021. The plant has a warehouse-refrigerator for storing finished products at -20°C with 10 thousand pallet spaces. The company's production processes are certified according to the BRC Global Standard for Food Safety . A significant volume of the company's products (90%) is exported to European countries (Poland, Italy, Spain, Germany, and others) as well as to Asian countries. The plant also works with tolling raw materials in terms of sorting, cutting, packaging, freezing, and storage.

Eco Berry was founded in 2017 and is based in the Ivano-Frankivsk region. The company grows, processes, and freezes a wide range of berries, including strawberries and raspberries. Some of the frozen berries are exported.

[19] Modern technologies of processing and storage of fruits and berries. URL: https://lib.mnau.edu.ua/info5/2022/pereob_yag_2022-web.pdf.

[20] Modern technologies of processing and storage of fruits and berries. https://lib.mnau.edu.ua/info5/2022/pereob_yag_2022-web.pdf.

[21] The nut market: sales geography, exporters and production. https://kurkul.com/spetsproekty/1215-rinok-gorihiv-geografiya-prodajiv-eksporteri-i-virobnitstvo.

[22] Ukrainian Berry Industry Catalogue 2023. https://www.agroberichtenbuitenland.nl/documenten/publicaties/2023/09/22/ukrainian-berries-industry-catalogue-2023

Yarofruit was founded in 2016 and is based in the Lviv region. The company purchases and processes (freezes) fruits and berries, including raspberries. The frozen products are supplied to bakeries and bakery plants, confectioneries, baby food companies, and canneries.

Alte Foods, which was founded in 2021, has production facilities in the Zhytomyr region. The company uses freezing equipment from the Swedish company OctoFrost Group and SORTEX PolarVision system for quality control.

Amethyst-Ole was founded in 2011 in the Zhytomyr region. The company freezes organic and conventional berries (including strawberries and raspberries), which are exported to the EU.

Walnut processors include Walnut Global LLC and Ukrainian Walnut. Walnut Global LLC produces walnuts in the shell, peeled, chopped, and as a walnut paste. Ukrainian Walnut produces walnut kernels, walnuts in shell, crushed and unbroken shells. The company has its own plantations in Vinnytsia region. In general, walnuts are grown mainly by households [23].

The processing of fruits and berries into juice in Ukraine is dominated by large companies. In particular, in 2021, the largest producers of fruit and vegetable juices were: 1) PepsiCo (TM Sandora, TM Sadochok) - 53% of sales in Ukraine; 2) Vitmark-Ukraine holding (TM Nash Sik, TM Jaffa) - 21%; 3) T.V. Fruit group of companies (TM Galicia, TM Filvarok) - 9%; 4) Coca-Cola (TM Rich) - 7%; 5) other producers - 10% [24]. After the start of the armed aggression, the share of the largest producers decreased slightly. In particular, in 2023, the largest juice producers were: 1) Vitmark-Ukraine holding - 41%; 2) T.V. Fruit group of companies - 13%; 3) Coca-Cola - 7%, 4) PepsiCo - 5%; 5) other producers - 34%.

The Satanivsky cannery is located in the village of Satanivka, Horodok district, Khmelnytskyi region. The plant produces a wide range of canned fruit, berry, meat and vegetable products. In particular, it produces raspberry jam, walnut jam, apple jam, strawberry jam, apple-strawberry jam, apple-cherry jam, etc. The plant receives fruits and berries from local farms.

Today, Ukraine's walnut industry is involved in minimal deep processing (oil, jam, paste). The largest processors are enterprises that grow walnuts and carry out their primary processing before exporting them.

Processing volumes. The table below shows the volumes of fruit and berry processing. In 2017-2022, primary and deep processing of fruits and berries had a general upward trend. The volume of fruit and berry freezing increased especially. After the start of the armed aggression, processing volumes decreased significantly, except for freezing. It is worth noting that the freezing of fruits and vegetables has been growing rapidly in recent years, driven by demand in foreign markets. In particular, in 2017-2023, physical exports grew annually despite the COVID-19 pandemic and armed aggression. While in 2017, the company exported products worth USD 61.0 million, in 2023 it exported products worth USD 132.0 million.

Table 2.2. Volumes of fruit and berry processing in Ukraine

Sources: Statistical Yearbook of Ukraine 2022, Production of industrial products by type (in physical terms). URL: https://ukrstat.gov.ua

Products	2017	2018	2019	2020	2021	2022
Fruits and nuts, fresh or steamed or cooked in water, frozen (10.39.21.00)[25], thousand tons	16.3	19.0	14.6	15.7	30.2	52.0
Jam, marmalade, puree, jelly, preserves, preserves, other fruits and nuts, subjected to heat treatment (except for homogenized products) (10.39.22.90), thousand tons	44.4	63.2	57.1	51.9	56.3	31.1
Mixtures of fruit and vegetable juices (10.32.17.00), million liters	186.8	184.3	188.6	171.5	198.4	113.4
Juice from any one type of fruit, nut or vegetable, unfermented and without added alcohol (except orange, grapefruit, pineapple, tomato, grape and apple juice), unconcentrated (10.32.19.20), million liters	69.9	75.8	70.8	65.9	76.3	28.1
Apple juice (10.32.16.00), million liters	74.0	105.9	100.6	63.4	97.6	92.1

[23] The nut market: sales geography, exporters and production. URL: https://kurkul.com/spetsproekty/1215-rinok- gorihiv-geografiya-prodajiv-eksporteri-i-virobnitstvo.

[24] Where did Sandora's customers go and how did the new product from Morshynskyi enter the market? URL: https://rau.ua/personalii/num8erz-insightspanel-analiz-povedinki-pokupciv/

[25] Product code by the Nomenclature

1.5. Climate change's impact on fruit, berry and nut production, exports and processing

Crop production, and in particular fruit and berry production, is highly sensitive to climate and weather. In Ukraine, there is an increase in the frequency and severity of droughts during the growing season; an increase in the frequency of natural hydrometeorological events in the warm season (heavy rains, thunderstorms, tornadoes, squalls, hail, etc.); changes in the nature of precipitation during the growing season (decreased frequency and increased intensity of precipitation), which impedes the efficient accumulation of soil moisture, worsens harvesting conditions and product quality; increased frequency and intensity of late spring frosts; lack of stable snow cover (low snowfall in winters), which, in the context of periodic significant temperature drops, increases the risk of crop freezing. Over the past 30 years, the average annual temperature in Ukraine has increased by 1.2°C, and over the past 10 years by 1.7°C[26] . The average level of precipitation has decreased by 1.5-2%. Accordingly, the need for crop irrigation is growing.

Researches on the frequency of severe and extreme droughts in the most vulnerable southern part of Ukraine over the past thirty years have shown a 63% decrease in cases of extremely wet conditions and a 3-fold increase in cases of extreme drought[27]. In general, the frequency of droughts in different agroclimatic zones of Ukraine is 20-40%[28]. Over the past 20 years, droughts have recurred almost twice as often. There is also a dangerous tendency to increase the frequency of drought conditions in the zone of sufficient atmospheric moisture, which covers Polissya and the northern regions of the Forest-Steppe.

The last frosts in the air in Ukraine can be observed between February 22 and May 26[29]. They are most often observed in April (66% of cases), less often in May and March (19% and 15% of cases, respectively). Their frequency of occurrence in the third decade of March, the second decade of April, and the first decade of May is about 14-16%. In the second and third decades of May, the last spring frosts are observed with the lowest frequency (1-3%), but they cause the greatest damage to fruit crops as they occur during the ovary formation phase.

In the future, winters are expected to be warmer and summers hotter. Due to global warming, the climate in Ukraine has warmed by 1.3 degrees over the past 100 years, which is higher than the global rate. Therefore, characteristic changes in the seasonal redistribution of temperature and precipitation are being recorded. In addition, according to scientists, global warming will gradually take away spring from Ukrainians. The meteorological autumn in Ukraine has also been shortened[30]. More humid weather is likely in the colder months and drier weather in the warmer months. Southern and central regions of Ukraine will become drier, while northern regions will become wetter. The average temperature is also expected to rise compared to the period 1991-2010.

In the fruit and berry sector, an increase in the average annual air temperature causes a reduction in the ripening period of long-term storage fruits and a decrease in the harvesting window[31] . Sharp temperature fluctuations in winter during the day and night cause sunburn, frost damage to the bark, cambium, wood, branches, and trunk of fruit trees, up to the complete death of the aboveground part of the plants. Strong insolation in summer leads to sunburn of leaves and fruits and slows down the synthesis of plastic substances. This, in turn, renders the harvest non-marketable and unsuitable for storage. Fruits are affected by vitreousness and berry bushes by wilting.

Uneven rainfall is no less threatening for fruit and berry crops. Thus, the consequences of prolonged drought in summer are slower metabolic processes, weaker differentiation of generative buds, shedding of fruits, deterioration of their taste, and a non-marketable harvest with clear signs of functional disorders. Insufficient moisture supply in winter causes freezing of the root systems of plants, their vegetative organs, and generative

[26] Ukraine Climate and Development Report: Agriculture. https://kse.ua/wp-content/uploads/2024/03/CSA_uk.pdf

[27] Maidanovych N., Saydak R., Knysh V. Comparative analysis of the drought events frequency in Southern Ukraine according to SPI and HTC indicators. DOI:10.31473/2305-5987-2022-2-31(45)-13

[28] Climate change: impacts and adaptation measures. https://niss.gov.ua/sites/default/files/2020-10/dop-climate-final-5_sait.pdf

[29] Oleksienko I.M. Spatial and temporal distribution of frosts in Ukraine and their impact on fruit crops. https://scc.knu.ua/upload/iblock/725/dis_Oleksienko%20I..pdf

[30] From winter to summer: scientists explain why springs are disappearing in Ukraine. https://apostrophe.ua/ua/news/society/2025-02-05/iz-zimyi--srazu-v-leto-uchenyie-obyyasnili-pochemu-v-ukraine-ischezayut-vesnyi/338912

[31] Shevchuk L. Features of gardening in the context of climate change. Presentation on 10 July 2024.

formations, thereby reducing the yield below the planned one. Heavy rainfall in the first half of the plant growing season leads to intensive shoot growth, low flower bud set, reduced fruiting frequency, and consequently, lower yields. Excessive precipitation before and during harvesting leads to cracking of fruits (cherries, plums, apricots, apples), fruit rot, deterioration of taste, and poor keeping quality.

As for extreme weather events, they result in significant crop losses for horticulture and berry growing. For example, storms lead to fruit shedding and reduced crop yields; hail damages fruits and leaves, resulting in low-quality, non-standard harvests. Frosts after thaws in winter cause sap flow, complete or partial freezing of buds and wood, and thus a lack of harvest. Spring frosts cause damage to young plant shoots, flowers, ovaries on fruit and berry crops, low yields or even a complete lack of yield, and poor fruit quality. Spring dry winds worsen the quality of pollen, cause inferior and poor pollination, and lead to low crop yields and poor-quality fruit.

Over the past 20 years, there have been significant changes in the location of Ukrainian fruit and berry production. They were primarily caused by an increase in average annual air temperature and a decrease in available moisture in the Steppe and southern Forest-Steppe regions. Warming allows for successful fruit and berry growing in the northern and northwestern regions, where there is a better supply of moisture, while in the southern and southeastern regions, successful fruit and berry growing is currently hampered by prolonged droughts, high insolation in summer, lack of moisture, etc. Military actions have also affected the location of fruit and berry production due to the need to relocate production from the occupied and frontline territories. Military actions made production impossible in a large part of the South, while warming and the shift of climatic zones to the north allowed the production of crops requiring a higher sum of active and effective temperatures for vegetation and fruiting to be moved to the northern and western regions. Thus, in 2000, the main regions (ranked) in terms of pome fruit production were Dnipropetrovs'k (south-east), Zakarpattia (west), Donetsk (south-east), Lviv (west), Vinnytsia (central-west) regions, and now they are Vinnytsia (central-west), Chernivtsi, Khmelnytskyi, Lviv, and Ternopil (all of them are west) regions. In 2000, the leaders in stone fruit production were Dnipropetrovsk, Donetsk, Kherson, Odesa and Zaporizhzhia regions (all of them are south and south-east), while in 2023, they were Odesa (south), Poltava (east), Khmelnytskyi (west), Dnipropetrovsk (south-east), and Rivne (north-west) regions. There have been some changes in the production of berry crops. In 2000, most berries were produced in Donetsk, Dnipropetrovs'k (both are south-east), Lviv (west), and Zhytomyr (north) regions, and in 2023 - in Dnipropetrovs'k (south-east), Kyiv (north), Zhytomyr (north), Lviv (west), and Vinnytsia (central-west) regions. While in 2000, the main volumes of nuts were produced in Dnipropetrovsk, Donetsk (both are south-east), Lviv, Khmelnytskyi, Chernivtsi (all of them are west) regions, in 2023, the main producers were Cherkasky (central-east), Khmelnytskyi (west), Chernivtsi (west), Odesa (south), Vinnytsia (central-west) regions.

a) Climate change's impact on exports

Climate change and trade are closely related. Climate change can alter the comparative advantage between countries, which in turn can cause changes in global commodity markets.

An example of the impact of climate change on exports was the increase in the prices of frozen raspberries on the world market in 2024 due to abnormal heat in the main production regions of Ukraine.

On the other hand, trade itself is a strategy for adapting to climate change, moving trade flows from countries with surpluses of agro-food products to countries with deficits formed because of climate change.

In addition, climate change has resulted in accelerated growth in the production and export of agricultural products grown in greenhouses. One key aspect of greenhouse farming is that it can develop a suitable ecosystem and protect from extreme climate conditions for crop production. According to the forecast of Growth Market Reports[32] , the greenhouse segment globally accounted for a large market share in 2022 and is anticipated to register a Compound annual growth rate of 9.9% during the forecast period till 2031. In particular, experts of the berry market note that the southern regions of Ukraine, where the most strawberries are grown, currently face the task of gradually transferring production to closed or protected soil. Due to climate changes, unstable weather conditions, production in the open field becomes unpredictable and often unprofitable. The transition to the

[32] Horticulture Market Size, Share, Analysis & Forecast | 2031. Growth Market Reports. https://growthmarketreports.com/report/horticulture-market-global-industry-analysis

greenhouse is the most promising direction in these regions, especially from the point of view of receiving early off-season products[33].

b) Impact of climate change on processing

According to the Strategy for Environmental Security and Climate Change Adaptation until 2030 (Resolution of the Cabinet of Ministers of Ukraine No. 1363 of 20.10.2021), the processing industry is not directly related to the socioeconomic sectors that are vulnerable to the effects of climate change. Enterprises that process fruits, berries, and nuts will be indirectly affected by problems with water and energy supply. Enterprises are likely to experience water shortages and face a decline in water quality due to an increase in toxic algae, especially in summer. However, it should be considered that processing companies can generate excessive greenhouse gas emissions because of production activities (heating, cooling, freezing, transportation), as well as exacerbate environmental problems by using single-use plastic packaging.

At the same time, high temperatures will increase the risk of power supply instability and increased greenhouse gas emissions for the following reasons: 1) reduced electricity generation at NPPs and TPPs due to lack of water for cooling; 2) reduced electricity generation at hydroelectric power plants due to droughts and loss of water to evaporation; 3) increased demand for electricity in summer from air conditioning and cooling systems; 4) reduced reliability of transmission in power grids due to high air temperatures, etc.

c) Adaptation of processors to climate change

Adaptation in the EU. In July 2021, the EU developed a Code of Conduct to promote environmental standards among food producers (EU Code of conduct on responsible food business and marketing practices). The Code entered into force in July 2021 after being signed by 65 companies and organizations. The Code of Conduct is one of the first derivative documents developed under the Farm to Fork Strategy.

The purpose of the Code is to create conditions for sustainable development of food processing, restaurant, wholesale, and retail food businesses. The companies that have joined the Code of Conduct make voluntary commitments to adapt to climate change and report on their implementation on an annual basis. Among the companies that were the first to sign the code were Coca-Cola, Danone, Ferrero, Metro AG, Mondelez, Nestle, PepsiCo, Unilever, and others.

Among the best practices applied and disseminated in the EU among processing companies are the following: use of electricity from renewable sources; refusal to use packaging made from fossil fuels; transition to reusable packaging; conversion of the truck fleet to electric vehicles; installation of infrastructure for charging electric vehicles; accounting for greenhouse gas emissions caused by the company's activities; modernization of the ventilation and air conditioning system; conversion of boilers from fossil fuels to natural gas.

Adaptation to climate change and mitigation of its consequences at large processing enterprises in Ukraine

[33] https://fruit-ukraine.org/2022/01/25/perspektyvy-iahidnoho-rynku-u-2022-rotsi-tsiny-eksport-obsiahy-vyrobnytstva/

Large companies are also leading the transition to green processing and climate change adaptation in Ukraine. The incentives for the transition are high prices for fossil fuels and the need to create a positive environmental image of the company in a competitive market.

In the area of environment and adaptation, Danone Ukraine complies with national environmental legislation, modernizes production facilities to reduce the environmental footprint of production, takes measures to reduce the consumption of non-renewable natural resources, tracks the carbon footprint of dairy products using the Dairy Danprint tool, tracks the carbon footprint of milk suppliers using the Cool Farm tool, and organizes internal environmental audits with the involvement of international experts from ERM and Veolia.

PepsiCo is actively working to implement modern energy-saving technologies at all its production sites in Ukraine to reduce the consumption of scarce resources. In recent years, water and electricity consumption for the technical needs of beverage and juice production has been reduced by 3% annually. The amount of solid waste is also decreasing year on year. One of the company's environmental achievements was the commissioning in 2013 of a set of modern biological treatment facilities at the juice production plant in the village of Mishkovo-Pogorilove, Mykolaiv region.

T.V. Fruit Group's plants process fruit pomace into biofuel, which has helped the company to stop using natural gas. The company also uses wood waste (chips), cherry pits, and pellets made from sunflower and corn processing waste for energy needs. The company uses packaging materials that are produced in the vicinity of its facilities, thus generating no packaging waste. The juice concentrate is transported in reusable containers: tanks, barrels, flexi-tanks. In the context of waste-free production, the company has introduced the production of pectin from apple pomace, which was previously classified as waste.

OJSC Mohyliv-Podilskyi Cannery converted its natural gas-fired boiler to biofuel (compressed pellets from sunflower processing waste, wood processing waste, etc.). Heat pumps were installed in the office premises for heating in the autumn and winter.

To save water, Kaniv Cannery uses high-pressure hoses and water reuse and recycling systems. The warehouse uses reusable containers (cardboard boxes) to transport finished products. The plant's refrigeration equipment needs to be replaced as it contains substances that deplete the ozone layer: chlorofluorocarbon and hydrochlorofluorocarbon (Freon).

d) State incentives for the adaptation of processing enterprises to climate change

State incentives for processing enterprises to adapt to global warming are provided in Ukraine in the following areas: 1) harmonization of Ukrainian and EU regulations on fruit, berry and nut processing; 2) development of comprehensive strategic documents for adaptation to climate change; 3) promotion of best practices for sustainable production processes in the face of climate change; 4) coordination of international cooperation to preserve the ozone layer and the environment.

Harmonization of recycling standards. Harmonization of adaptation standards is a continuation of harmonization in the context of European integration (Association Agreement between Ukraine, on the one hand, and the European Union, the European Atomic Energy Community and their Member States, on the other hand; Title V “Economic and Sectoral Cooperation”; Chapter 17 “Agriculture and Rural Development”; Articles 104, 105). Harmonization covers standards for production, packaging, labeling, and waste management. The list of Ukrainian standards and relevant EU standards for processing of fruits, berries, and nuts is provided in Annex 2 and Annex 3, respectively.

As part of the EU project “Support for Agricultural and Food Policy Implementation in Ukraine” (SAFPI), the harmonization of the current voluntary standards of Ukraine (DSTU: 4900:2007 Jams. General technical conditions; DSTU 4333:2018 Marmalade. General technical conditions; DSTU 6094:2009 Fruit jellies. Technical specifications) and Council Directive 2001/113/EC of 20 December 2001 relating to fruit jams, jellies and marmalades and sweetened chestnut puree intended for human consumption. Representatives of the Ministry of Agrarian Policy, the State Service of Ukraine for Food Safety and Consumer Protection, industry associations, producers, importers, etc., were involved in the harmonization of these standards. The harmonization process was completed with the adoption of the Order of the Ministry of Agrarian Policy and Food of Ukraine No. 391 ‘On Approval of the Requirements for Fruit Jams, Jellies, Marmalades, and Sweetened Chestnut Puree’ dated 14 February 2024.

Comparison of Ukrainian and EU standards. Comparison of Ukrainian standards (DSTU 4283.1:2007, DSTU 4283.2:2007 Juices and juice products; DSTU 7159:2010. Canned juices reconstituted) and EU standards (Council Directive 2001/112/EC of 20 December 2001 concerning fruit juices and certain similar products intended for human consumption) determines the directions of their harmonization. In particular, the Ukrainian standards need

to be aligned with the terminology, the list of permitted ingredients, processing methods, the content of pulp or concentrated juice/puree in fruit nectars, and the minimum soluble solids content. As for the standards for fruit jams, jellies, and marmalades, it is necessary to introduce a provision in the national standards that the basis to produce jellies should be natural raw materials, as provided for in EU directives. At present, domestic standards allow for the addition of artificial and synthetic coloring agents to jellies.

e) Recommendations for adaptation to climate change

In fruit, berry, and nut processing, water and energy supply are of great importance, and they are at risk under climate change. Given these circumstances, it is recommended to take the following measures to increase the production sustainability of enterprises: 1) reducing water and energy consumption through water and energy efficiency methods; 2) introducing innovative technologies and equipment that save water and energy consumption; 3) transitioning to self- sufficiency in water and energy (artesian wells, wind turbines, photovoltaic panels, local biofuels and biogas, etc.) to the maximum extent possible, depending on local opportunities 4) implementation of water purification and reuse systems (reverse osmosis, ultraviolet water purification, membrane bioreactors, etc.); 5) implementation of rainwater collection and storage systems for technical purposes (industrial use of BlueBloqs technology); 6) implementation of autonomous “Behind-the-meter” power supply systems (solar panels, wind turbines, lithium-ion energy storage batteries, heat pumps); 7) conversion of the warehouse and freight vehicle fleet to electric vehicles; 8) use of refrigeration equipment without hydrofluorocarbons, hydrochlorofluorocarbons, chlorofluorocarbons, etc.; 9) use of packaging materials that are not made from fossil fuels (biodegradable plastic, recycled plastic, paper, cardboard, glass, biodegradable packaging made of corn starch, pulp, wheat straw plastic; packaging made of recycled materials (aluminum, glass), etc.); 10) use of reusable packaging (tanks, barrels, flexi-tanks, etc.); 11) conversion of fossil fuel boilers to pellets made of organic materials (sunflower, corn, wood, fruit, etc.).

It is also important for processing companies to support organic agriculture, which involves the implementation of the following measures: 1) obtaining raw materials from organic producers who do not use mineral fertilizers, pesticides, etc.; 2) obtaining raw materials from suppliers certified by environmental institutions (Fairtrade, Rainforest Alliance, etc.); 3) converting their own agricultural branches to organic farming; 4) providing technical assistance to small suppliers of raw materials (farmers, households) on best practices in organic and biodynamic farming.

02 THE REGULATORY AND LEGAL FRAMEWORK OF UKRAINE TO ENSURE THE CLIMATE ADAPTATION OF FRUIT AND BERRY PRODUCTION, PROCESSING, AND EXPORTS

2.1. Definition of the concept of climate adaptation in agricultural production

The Law of Ukraine "On the Basic Principles of State Climate Policy" defines climate change adaptation as "a process aimed at reducing the vulnerability or ensuring the resilience of socio-ecological systems and infrastructure to the impact of climate change in order to adapt to new climate conditions, prevent (reduce) the negative effects of climate change"[34]. The definition of the term "climate adaptation" in Ukrainian legislation is largely consistent with the relevant international interpretations of this concept.

For example, the United Nations Development Programme (*UNDP*) defines climate change adaptation as actions that help reduce vulnerability to current or expected climate change impacts, such as extreme weather events and hazards, sea level rise, biodiversity loss, or food and water insecurity[35]. The Global Goal on Adaptation (or GGA) is a key component of the Paris Agreement[36]. It commits all parties to the agreement to build resilience, reduce vulnerability, and support adaptation actions.

The United Nations Framework Convention on Climate Change (*UNFCCC*) defines climate adaptation as the adjustment of environmental, social, or economic systems in response to actual or expected climate forcings and their impacts[37]. Adaptation is a critical component of a long-term global response to climate change to protect people, livelihoods, and ecosystems.

Similarly to the UNFCCC, the Intergovernmental Panel on Climate Change (*IPCC*) has defined adaptation to climate change[38] . Adaptive capacity is defined as the ability of a system to adjust to climate change (including climate variability and extreme events) to reduce potential damages, take advantage of opportunities, or cope with impacts. Adaptation activities include five general components: observation, assessment of climate impacts and vulnerability, planning, implementation, and monitoring and evaluation of adaptation measures.

The EU recognizes the importance of ensuring the adaptability of agriculture to climate change, as the agricultural sector is one of the main drivers of climate change, emitting methane, nitrous oxide, and carbon dioxide, which is mainly related to land use, fertilization, and livestock[39]. In turn, climate change affects European agriculture and requires adaptation of agricultural systems and farmers. Rising temperatures and carbon concentrations in the atmosphere, changes in precipitation patterns and more frequent extreme events are affecting crop yields and livestock productivity in Europe, as well as water management and transport and storage conditions. In particular, more frequent extreme weather events are expected to have widespread and detrimental effects on agricultural production across Europe.

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[34] The Law of Ukraine "On the Basic Principles of State Climate Policy". https://zakon.rada.gov.ua/laws/show/3991-20#Text

[35] What is climate change adaptation and why is it important? https://climatepromise.undp.org/news-and-stories/what-climate-change-adaptation-and-why-it-crucial

[36] *The Paris Climate Agreement is an agreement under the United Nations Framework Convention on Climate Change adopted on 12 December 2015. Ukraine was one of the first European countries to join it in 2015* and ratified it on 17.07.2016 (see Paris Agreement. https://zakon.rada.gov.ua/laws/show/995_l61#Text)

[37] Adaptation and resilience. https://unfccc.int/topics/adaptation-and-resilience/the-big-picture/introduction

[38] Annex B. Glossary of terms. https://archive.ipcc.ch/ipccreports/tar/wg2/index.php?idp=689.

[39] Agriculture. https://climate-adapt.eea.europa.eu/en/eu-adaptation-policy/sector-policies/agriculture

The FAO defines two main types of agricultural adaptation to climate change - autonomous and planned adaptation[40]. Autonomous adaptation is the response of, for example, a farmer to a change in precipitation patterns by changing crops or using different harvest and sowing dates. Planned adaptation measures, on the other hand, are deliberate policy options or response strategies, often multisectoral in nature, aimed at changing the adaptive capacity of an agricultural system or facilitating specific adaptations. For example, deliberate crop selection in different agro-climatic zones, replacement of old crops with new ones, and substitution of inputs caused by scarcity. FAO also distinguishes long-term adaptation as major structural changes to overcome adversity, such as changes in land use to maximize yields under new conditions, the use of new technologies, new land management practices, and practices related to the efficient use of water.

At the same time, the above definitions show a close relationship between the concepts of climate adaptation and climate resilience. However, these concepts are not identical, although they complement each other. Adaptation is the process of adjusting to the actual or expected climate change and its consequences, while resilience is the ability to prepare for these consequences, in particular, the ability to recover from dangerous climate events[41]. Further, we believe that it is necessary to focus primarily on adapting agriculture to climate change as an important stage in further ensuring the climate resilience of agricultural production.

2.2. Ukraine's climate policy, climate-adapted development of the agricultural sector, and production of fruits and berries

a) Strategic documents

After the proclamation of the European Green Deal (EGD; 2019), the Government of Ukraine expressed its readiness to develop a balanced approach to its implementation. In January 2020, the Interagency Working Group on Coordination of Counteraction to Climate Change within the EGD was established; in August, a position paper on Ukraine's participation in the EGD was submitted, which proposed to establish a dialogue with the EU on modalities for early involvement of the Ukrainian side in the development and implementation of policies in the context of the EGD, development of a joint Roadmap for Ukraine's participation; promising areas of cooperation within the EGD were identified. Since then, the EGD principles have been partially imbedded into adopted legal acts of Ukraine related to climate change and climate-friendly development of the agricultural sector. In particular, the strategic imperatives in the draft Recovery Plan for Ukraine of 2022 provide for synchronization with the European Green Deal, environmental safety, and integration of the environmental component into all reforms and projects[42], which will help prepare for EU accession.

Among the challenges and barriers to achieving strategic goals in ensuring a safe environment, the National Economic Strategy of 2021 pointed to the lack of a comprehensive coordinated policy on climate change adaptation in various sectors of the economy and public life[43]. Based on the analysis of strategic documents (strategies, plans, concepts), both general and sectoral, in areas related to climate change as of 2024, experts confirm the conclusion that there is no comprehensive policy on climate change adaptation in various sectors of the economy[44]. It should be noted that the European Commission, in its report on Ukraine as part of the EU enlargement package of 08 November 2023, recommended the climate law to be adopted in the near future (the law has already entered into force on October 30, 2024) and the long-term low-carbon strategy to be updated in line with the EU's 2030 framework[45].

[40] Adaptation to climate change in agriculture, forestry and fisheries: Perspective, framework and priorities. https://openknowledge.fao.org/server/api/core/bitstreams/d1c8c528-4839-4229-b515-172630b55f90/content

[41] Mitigation, adaptation and resilience: What's the difference? https://www.dlapiper.com/en-sg/insights/topics/cop-conference-of-the-parties/mitigation-adaptation-and-resilience

[42] Ukraine's recovery plan. https://ua.urc2022.com/plan-vidnovlennya-ukrayini.

[43] Resolution of the Cabinet of Ministers of Ukraine No. 179 dated 03.03.2021. "On Approval of the National Economic Strategy for the period up to 2030". https://zakon.rada.gov.ua/laws/show/179-2021-%D0%BF#Text

[44] Prospects for the development of the agrarian sector of Ukraine in the context of climate change: analytical report / [V.M. Rusan, L.A. Zhurakovska, Y.A. Zhalilo et al. https://niss.gov.ua/sites/default/files/2024-07/ad_klimagrosektor_03_07_24_zminena.pdf.

[45] Ukraine 2023 Report Accompanying the document Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions. COMMISSION STAFF WORKING DOCUMENT. EUROPEAN COMMISSION Brussels, 8.11.2023 SWD (2023) 699 final. https://neighbourhood-enlargement.ec.europa.eu/system/files/2023-11/SWD_2023_699%20Ukraine%20report.pdf.

Climate policies. The Law on the Basic Principles of the State Climate Policy provides for the development of a Climate Change Adaptation Strategy for a ten-year period, as well as Sectoral Programme Documents for reducing greenhouse gas emissions and increasing their removal, which will contain specific measures in the relevant sectors[46], including agriculture. The functioning of organizational and economic mechanisms for achieving low-carbon development goals will be carried out through, among other, the introduction of more environmentally friendly agricultural practices, conservation of degraded land, etc.

In 2021, Ukraine started (de jure) implementing a system for regulating greenhouse gas emissions (the MRV system - monitoring, reporting and verification) covering the activities of business entities, according to the adopted Law "On the Principles of Monitoring, Reporting and Verification of Greenhouse Gas Emissions" of 2019[47]. However, reporting on GHG emissions from crop production that was expected in the 2021-2022 marketing year, has been postponed due to the war.

The documents on Ukraine's Updated Nationally Determined Contribution to the Paris Agreement (NDC2) propose achieving the largest reduction in greenhouse gas emissions in agriculture through the following measures :

- promoting the use of minimum tillage technologies (on an area of 5 million hectares, with an estimated potential of 17 million hectares, given certain limitations on the application of these technologies in relation to crops and territories);
- promoting organic crop production (on an area of 2 million hectares);
- reducing greenhouse gas emissions from livestock, namely through the feeding regime for farm animals (specific diets and supplements), which will lead to a reduction in GHG emissions;
- use of nitrogen fertilizers with slow or controlled release of nutrients, use of information technology in crop production[48].

The Strategy for Environmental Security and Adaptation to Climate Change until 2030 (Resolution of the Cabinet of Ministers of Ukraine No. 1363 of 2021) identifies agriculture and soil as socio economic sectors that are vulnerable to the effects of climate change. The strategic goals of the general plan, including ensuring the rational use of natural resources, strengthening the adaptive capacity and resilience of social, economic, and environmental systems to climate change, are envisaged, which also apply to agriculture, but no specific goals have been set for the sector. Among the tasks are ensuring the development of organic agriculture, the application of conservation tillage practices with the preservation and enhancement of soil organic matter [49].

The most recently approved acts on the subject include the Strategy for the Formation and Implementation of State Policy in the Field of Climate Change for the Period up to 2035, Order of the Cabinet of Ministers of Ukraine of 30.05.2024 No. 483[50]. Under strategic objective 2. Mitigating climate change and ensuring a socially just and economically efficient transition to low-carbon development of the state, in addition to the general objectives (reducing annual greenhouse gas emissions and increasing their absorption), the agriculture sector is expected to increase the area of agricultural land with organic status and carbon farming and ensure the use of drained land with peat soils for agriculture. Under strategic objective 3. Adaptation to climate change, increasing resilience and reducing risks associated with climate change, the strategic objective provides for conducting sectoral studies on risk assessment, vulnerability and climate change forecasting in the field of agriculture and soils (2025) and approving relevant programme documents (on planning) for climate change adaptation (2026) and an ambitious expected result - ensuring the transition to climate-resilient food production and agricultural production.

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[46] The Law of Ukraine 'On the Basic Principles of State Climate Policy' of 08.10.2024 No. 3991 https://zakon.rada.gov.ua/laws/show/3991-20#Text

[47] The Law of Ukraine "On the Principles of Monitoring, Reporting and Verification of Greenhouse Gas Emissions" of 2019, No. 377. https://zakon.rada.gov.ua/laws/show/377-20#Text.

[48] Climate Change Mitigation Policies and Measures (to Report 4) (for discussion). https://mepr.gov.ua/files/images/news_2020/22122020/%D0%BF%D0%BE%D0%BB%D1%96%D1%82%D0%B8%D0%BA%D0%B8%20%D1%82%D0%B0%20%D0%B7%D0%B0%D1%85%D0%BE%D0%B4%D0%B8.pdf

[49] Order of the Cabinet of Ministers of Ukraine of 2021 No. 1363 "On Approval of the Strategy of Environmental Security and Adaptation to Climate Change for the Period up to 2030". https://zakon.rada.gov.ua/laws/show/1363-2021-%D1%80#Text.

[50] On Approval of the Strategy for the Formation and Implementation of the State Policy in the Field of Climate Change for the Period up to 2035 and Approval of the Operational Plan of Measures for its Implementation in 2024-2026, Order of the Cabinet of Ministers of Ukraine of 30.05.2024 No. 483. https://zakon.rada.gov.ua/laws/show/483-2024-%D1%80#Text.

Agriculture. In addition to the overall national climate change regulatory framework, it is important to develop relevant sectoral regulations, in particular on climate-adapted development of the agricultural sector, which should be in line with the EU approach, thematic regulations, and the instrument for their implementation - the EU Common Agricultural Policy (CAP).

The Strategy for the Development of Agriculture and Rural Areas in Ukraine until 2030 adopted in 2024, aims to prepare the agricultural sector for EU accession, ensure sustainable development, and create favorable conditions for the formation of a competitive, sustainable and diversified agricultural sector that ensures long-term food security, enhanced environmental protection, and mitigation of climate change[51]. Strategy declares Goal 5: Climate-smart agriculture: mitigation and adaptation to climate change; the goal has two objectives: 1. Promote climate change mitigation and adaptation (this includes reforming water management, developing organic production, circular bioeconomy, etc. Prevention of biodiversity loss, improvement of ecosystem services and conservation of habitats and landscapes). However, there are only three indicators that will allow assessing the results of implementation of strategic goal 5, namely: the share of agricultural land under organic production in the total area of agricultural land; the percentage of agricultural waste used or recycled (and the same indicator for food industry waste).

It is noteworthy that the Strategy of Ukraine's environmental goals is limited and does not reflect the EU CAP goals. The EU's Common Agricultural Policy for the 2021-2027 programme period has three environmental goals: a) Combating climate change, b) Caring for the environment, c) Conservation of landscapes and biodiversity. There are also limited indicators in the Strategy of Ukraine under strategic objective 5, which have little to do with the content of the objective "mitigation and adaptation to climate change" compared to the seven indicators set out in the EU CAP (in particular, specific indicators for reducing emissions, carbon storage in soils and biomass, renewable energy from agriculture and forestry, targeted investments, and the share of land covered by forests).

In the Strategy for the Development of Agriculture and Rural Areas in Ukraine until 2030, Goal 5: Climate-oriented agriculture should prioritize establishing a Sectoral Programme for the reduction of greenhouse gas emissions and increase of their removal in agriculture.

The status indicators for the targets set by the European strategies (Farm to Fork and Biodiversity) under the EGD for agriculture at the EU level and in Ukraine are presented in Annex 1.

The official documents of Ukraine do not provide for specific goals, objectives, or measures on climate change and the necessary adaptation for the fruit and berry sector. This sector's unique aspects regarding development and financial support are not addressed here. However, the EU legislative framework, as outlined in Section III of the report, does cover these features.

Therefore, it is recommended to supplement the Strategy for the Development of Agriculture and Rural Areas in Ukraine until 2030 with a relevant subsection on the development of fruit and berry production in Ukraine. This will be in line with the EU's guideline to include in the National CAP Strategic Plans of EU member states the objectives and types of support for agricultural producers, including in the fruit and berry sector. The proposed subsection of this strategic document should declare the development of a national strategy for the sustainable development of the fruit and berry sector with environmental . It is also necessary to set a task of the development of regulations on the recognition of producer organizations (POs) in the fruit and vegetable sector. The Draft Law of Ukraine on Associations of Agricultural Producers (Reg. No. 8149), adopted as a foundation with revised provisions (Resolution No. 3064 of the Verkhovna Rada dated 02.05.2023), has sparked significant debate and requires further improvement.

The current sectoral Programme for the Development of Horticulture in Ukraine until 2025 (approved by Order of the Ministry of Agrarian Policy and Food of Ukraine No. 444/74 of 2008) declares the strategic goal of horticulture development to be the expansion of production of environmentally friendly products by switching from industrial and chemical methods of farming to biological ones[52]. Regarding adaptation to climate change, the Programme provides for areas of greening production, irrigation systems, and technologies

[51] Order of the Cabinet of Ministers of Ukraine "On Approval of the Strategy for the Development of Agriculture and Rural Areas in Ukraine until 2030 and Approval of the Operational Action Plan for its Implementation in 2025-2027" of 15 November 2024, No. 1163. https://zakon.rada.gov.ua/laws/show/1163-2024-%D1%80#Text

[52] Programme for the Development of Horticulture in Ukraine for the period up to 2025, approved by the Order of the Ministry of Agrarian Policy and Food of Ukraine No. 444/74 of 2008. https://zakononline.com.ua/documents/show/55154___55154.

for growing environmentally friendly apples. The types of support include state aid for plantations and the implementation of a financial leasing support programme for the purchase of machinery.

With the Horticulture Development Programme set to expire in 2025, it is crucial to create a targeted programme for the subsequent period. The new programme, as a strategic policy and legal document, should align closely with the structure and content of the national strategy for sustainable operational programmes in the fruit and vegetable sector, as outlined in EU regulations. Environmental action must be integrated as a mandatory element. Additionally, the programme should address key aspects of the sector's development and financial support, including the procedure for recognizing producer organizations as a prerequisite for granting special support to farmers. In essence, the strategic provisions from the subchapter on fruit and berry cultivation, which are proposed as additions to the Strategy for the Development of Agriculture and Rural Areas in Ukraine until 2030, should be elaborated in the horticulture development programme for the upcoming period.

To address climate change and promote climate-adapted development in Ukraine's agricultural sector, including fruit and berry farming, several actions are necessary:

- Update the long-term low-carbon strategy to align with the EU 2030 framework.
- Develop a ten-year Climate Change Adaptation Strategy along with sectoral program documents aimed at reducing greenhouse gas emissions and enhancing their absorption. These sectoral programmes could be created within the framework of the Strategy for Environmental Security and Climate Change Adaptation (approved by the Cabinet of Ministers of Ukraine in 2021, Resolution No. 1363).
- Add a subsection on the development of fruit and berry production to the Strategy for the Development of Agriculture and Rural Areas in Ukraine until 2030. This addition should adhere to the EU guidelines for formulating national strategic CAP plans in EU member states.
- Create a new national horticulture development programme for the next planning period, incorporating initiatives and measures to strengthen the sector's resilience to climate change impacts.

b) monitoring of climate change, functioning of the information and early warning system

To ensure stable production and minimize risks, farmers need access to timely information that allows them to prepare for sudden weather changes and promptly address potential hazards. Continuous availability of meteorological data is essential to mitigate the adverse effects of climate change on agriculture. This includes daily weather forecasts, providing details such as air temperature, precipitation, wind, humidity, and cloud cover, which are crucial for organizing field activities like sowing, harvesting, and applying herbicides or fertilizers. Historical meteorological data help identify long-term trends in regional weather patterns, while information on extreme temperatures—both very high and very low—is vital to prevent heat or cold stress in plants.

The Strategy for the Formation and Implementation of the State Policy on Climate Change for the Period up to 2035 states that in order to achieve Strategic Objective 3 Adaptation to Climate Change, Building Resilience and Reducing Risks Related to Climate Change, the following tasks are to be performed: creation of a nationwide early warning system for various types of climate hazards and relevant information services, for which it is planned to increase the technical and technological capacity of the climate observation system of the national hydrometeorological service.

Climate change monitoring and the functioning of the early warning system in the agricultural sector of Ukraine are carried out by the Center for Analysis and Forecasting of Hydrometeorological Conditions of the Ukrainian Hydrometeorological Center , which is subordinated to the State Emergency Service of Ukraine.

The Regulation on the Ukrainian Hydrometeorological Center states that its tasks include analyzing and forecasting weather conditions, the hydrological regime of rivers and reservoirs, agrometeorological conditions of crops and their yields, and meteorological conditions for the formation of air pollution levels in Ukrainian cities.

The Department of Agrometeorology is directly involved in monitoring climate change,

functioning of the information, and early warning system. This department conducts research and assesses the patterns of formation of meteorological and climatic conditions of agricultural production over the territory and in time, evaluates the impact of meteorological factors on the development, condition and productivity of crops, forecasts the yield of major crops, provides agrometeorological information to agricultural production and justifies the fullest use of agroclimatic resources to increase productivity.

This department studies and quantifies the relationship between the conditions of individual farms and the processes of growth, development, and yield formation of crops. This allows us to use agrometeorological and agroclimatic data to assess the degree of weather and climate favorability for wintering and crop formation, to make decisions on the need for reclamation and various agronomic measures to obtain a high yield, etc.

The department also provides early information on the occurrence and development of drought, its intensity and coverage, which is the basis for making management and business decisions to mitigate the consequences and minimize losses. For example, it allows adjusting the structure of sown areas before sowing by increasing the area under drought-resistant crops or varieties or guiding farms to use moisture-saving technologies at the initial stages, etc.

The Agrometeorology Department has the most complete information on the condition of crops and current agrometeorological conditions for growing crops, which makes it possible to adequately and objectively assess the future harvest of major crops. The department receives and summarizes information from all meteorological stations that conduct field observations of the main crops that are a priority in a particular region.

The Department's functions include providing public authorities, the Ministry of Agrarian Policy and Food, agricultural organizations and agencies with the following agrometeorological materials: ten-day agrometeorological bulletins; agrometeorological forecasts, including crop yields and gross harvest; reviews of agrometeorological conditions for growing crops and their overwintering; agroclimatic reference books for the territory of Ukraine, regions, districts; agrometeorological yearbooks for the territory of Ukraine and for individual regions; special data on the conditions of growth and development of crops; results of ground surveys and agrometeorological characteristics of vegetation conditions, wintering of winter crops, perennial grasses, fruit trees, etc.; information on precipitation, soil moisture reserves, groundwater levels, snow cover, freezing depth, soil temperature at the depth of the tillering node, warming of the topsoil in spring, accumulation of effective heat, etc.

The main crops monitored are:

- Winter crops: wheat, rye, barley, rape
- Spring crops: barley, wheat, oats, corn
- Cereals and pulses: buckwheat, millet, peas, soya
- Technical: sunflower, spring rape, sugar beet
- Potato
- Perennial grasses
- Fruit, grapes

These crops are used to determine the following: plant development phases (phenological); crop condition assessment; plant height; sowing density; productivity and yield structure; productive moisture reserves; condition of wintering crops; and the degree of damage to plants by adverse weather events, pests, and diseases.

Ukraine has also established a state environmental monitoring system (SEMS) in accordance with the Law of Ukraine "On Environmental Protection", which ensures monitoring of the state of the environment and the level of its pollution. The SEMS is a system of observations, collection, processing, transmission, storage, and analysis of information on the state of the environment, forecasting its changes and developing scientifically based recommendations for making decisions on preventing negative changes in the state of the environment and meeting environmental safety requirements. Its priorities are to protect the vital environmental interests of humans and society, preserve natural ecosystems, avoid crisis changes in the environmental state, and prevent environmental emergencies[53]. Thus, it is one of the tools for ensuring climate resilience, as "climate resilience" is the ability to prepare for, recover from, and adapt to more frequent

[53] Resolution of March 30, 1998. N 391 On Approval of the Regulation on the State Environmental Monitoring System. Verkhovna Rada of Ukraine. https://zakon.rada.gov.ua/laws/show/391-98-%D0%BF#Text

and severe weather conditions, prolonged periods of drought and extreme temperatures, and other harmful effects of climate change[54].

The subjects of the monitoring system are the Ministry of Environment, the Ministry of Emergencies, the Ministry of Health, the Ministry of Agrarian Policy, the Ministry of Housing and Communal Services, the State Water Resources, the State Committee for Forestry, and the State Committee for Land Resources. These institutions are responsible for the SEMS.

Currently, the SEMS includes the following subsystems: monitoring in the field of atmospheric air protection; state water monitoring; land monitoring (land and soil monitoring); forest monitoring; flora monitoring; fauna monitoring; background environmental monitoring (in the territories of the nature reserve fund); monitoring of waste generation, storage and disposal sites; monitoring of the impact of genetically modified organisms on the environment.

Thus, in Ukraine, climate change in agriculture is monitored through the systems of the State Emergency Service (SES) and the Meteorological Service. These institutions collect and analyze data on temperature changes, precipitation, droughts, and other extreme events.

Ukraine has early warning systems for climate-related hazards, such as drought and other natural disasters. The data is transmitted to local authorities and farmers through official channels.

Modern technologies, including satellite observation and modelling, are used to forecast climate risks, for example, through the platforms of international partners such as the World Bank.

Among the challenges facing the further successful development of climate change monitoring and the functioning of the information and early warning system in agriculture are insufficient funding for monitoring and adaptation measures and the need to expand the use of modern technologies and create integrated climate data exchange platforms. There is also a negative impact of the war on ecosystems and monitoring infrastructure.

c) Best climate-adapted practices, technologies of climate adaptation and ecologization in Ukraine, and the provision of educational and advisory services for their dissemination.

The main goal of implementing climate-adapted practices in agriculture is to adapt it to climate change. Such practices focus on reducing vulnerability to the impact of extreme climatic conditions and thereby contributing to the resilience of agriculture to climate change. In this context, *measures* should be taken *to prevent soil erosion* (e.g., mulching, minimal tillage) and to *conserve water resources* (precise, drip irrigation, use of rainwater), as well as to *grow crops that are resistant to extreme temperatures and precipitation*. All of this will help to strengthen the resilience of agricultural production to the adverse effects of climate change and ensure the stability of harvests.

Environmental farming practices are closely related to climate-adapted ones, although the first are primarily aimed at minimizing the negative impact of agricultural production on ecosystems, in particular by reducing the use of chemicals. The main goal of implementing environmental practices is to preserve and restore the environment and maintain biodiversity. Accordingly, environmental practices include the use of crop rotation, cover crops, composting, predominant use of biological methods of pest and disease control, organic fertilizers, pest-resistant plant varieties and species, etc. Environmental practices primarily include organic farming, agroforestry, integrated plant protection, and the use of biofertilizers.

Thus, climate-adapted and Environmental practices, although different in their focus, can effectively complement each other in the process of ensuring the overall resilience of agricultural production.

In the EU, much attention is paid to the implementation of all these practices. Practices that already exist in EU standards are organic farming (Regulation 2018/848) and integrated pest management schemes (Integrated Pest Management (IPM) - Directive 2009/128/EC, which made the application of IPM principles mandatory from 2014). Other practices, including climate-adapted ones, are subject to mandatory conditions, which are the basis for financing farmers. These conditions are spelled out in the GAEC standards aimed

[54] What is climate resilience and why does it matter? Center for Climate and Energy Solutions. https://www.c2es.org/document/what-is-climate-resilience-and-why-does-it-matter/

at achieving agricultural sustainability. The EU also encourages additional initiatives by farmers to implement environmental and climate-friendly management practices.

Technologies of climate adaptation and ecologization in Ukraine. Before the full-scale war, advanced technologies, including environmental and climate-adapted technologies, were widely used in Ukrainian agriculture. In particular, conservation agriculture technologies (No-till, Mini-till, Strip-till, etc.), which focus primarily on Environmental but can also reduce moisture evaporation, protect the soil from erosion, restore its fertility and thus increase its adaptive capacity, as well as contribute to decarbonization. Such technologies were mainly used on cereals and spiked crops[55] . Arid steppe regions were the leaders in the implementation of such technologies. In 2023, Ukrainian farmers confirmed the trend of changing the way they cultivate the soil, namely, replacing ploughing with minimal tillage and deep loosening. According to the Ukrainian Agribusiness Club, in 2023, the use of ploughing decreased by 5%, while minimum tillage increased by 3% to 8% of cultivated areas[56].

In the pre-war period, there was also a large-scale increase in the use of sprayer drones in the agricultural services market. Domestic farmers recognized their main advantage as precise work in certain areas of crops without damaging the vegetation and soil compaction and significant savings in water resources. Thus, in 2021, the drones sprayed 1 million hectares, saving (compared to conventional sprayers) 5.5 million liters of fuel and 460 thousand liters of water (6–7 liters per hectare instead of 250 liters per hectare), and due to the absence of mechanical damage to crops during operation and as a result of timely technological operations, managed to harvest 157 thousand tons more [57]. It was also noted that the technology of drone spraying made it possible to reduce carbon dioxide emissions in Ukraine by 14 thousand tons in 2021.

Ukrainian companies developed competitive integrated technological solutions for irrigation systems, supplying the domestic market and supplying equipment to foreign countries. In addition, breeding activities in the last pre-war years intensified significantly, focusing on the development of the most productive crops adapted to the soil and climatic conditions of Ukraine.

The Ukrainian fruit and berry industry is developing mainly using intensive technologies that involve extensive use of chemicals and water, which has a negative impact on climate indicators. At the same time, producers (especially those working mainly for export) are gradually developing an understanding of the need to reduce the destructive impact on natural resources and implement climate-adapted practices. This trend can be expected to intensify with the intensification of European integration processes.

In modern fruit and berry production in Ukraine, over the past few decades, the issues of optimizing inputs and pesticide use, keeping row spacings free of weeds, and improving environmental friendliness and climate adaptability have gradually come to the fore. In particular, drip irrigation is widely practiced, integrated plant protection systems are used to protect plants from pests, and varieties are selected that are zoned for a particular area, do not have high requirements for moisture and nutrients, yield high yields, have excellent taste, and are resistant to diseases and pests.

Currently, the practice of growing berries indoors is becoming more widespread in Ukraine, particularly among berry growers. To this end, in several regions, berry farms are actively building film tunnels. Among these enterprises are those that operate using modern technologies: greenhouses and open areas are controlled remotely from a smartphone, power lines are installed on the territory, a water storage pool is placed, pipes for automatic irrigation are laid, and soil quality and saturation needs are monitored using modern methods.

Berry farmers are also gradually adopting agrivoltaics (a green energy trend that combines solar energy production and farming on the same land plot) to compensate for part of their own electricity consumption (primarily for refrigerators and irrigation systems) and subsequently sell their surplus, as well as to help reduce the farm's carbon footprint. So far, the only farm that has announced the use of this technology is located on an area of

[55] The state of implementation of No-till technology in Ukraine. https://agro-business.com.ua/agro/ahronomiia-sohodni/item/23100-stan-uprovadzhennia-tekhnolohii-notill-v-ukraini.html

[56] Farmers are moving away from traditional soil cultivation. Will ploughing become a thing of the past? https://agroportal.ua/publishing/analitika/agrariji-vidhodyat-vid-tradiciynogo-obrobitku-gruntu-chi-stane-oranka-lishe-istoriyeyu

[57] Drones protecting your wealth or How to reduce costs and increase yields in today's environment. https://propozitsiya.com/ua/drony-na-varti-vashyh-statkiv-abo-yak-zmenshyty-vytraty-i-pidvyshchyty-vrozhaynist-u-suchasnyh

about 33 hectares in the Zhytomyr region and is mainly engaged in sheep breeding but also has a small blueberry plantation and has started growing garden strawberries[58].

Annex 4 includes a summary list of climate-adapted agricultural practices prioritized for Ukrainian farmers to receive support in implementing.

An alternative to intensive production is ecological agriculture, primarily organic production. Organic strawberries and organic raspberries are grown in Ukraine, for example[59]. Some nut orchards are also focused on organic standards and environmental and climate sustainability[60]. In particular, to maintain soil fertility, retain moisture, and counteract erosion processes, special schemes are used to plant walnut trees; the land is not ploughed up but instead, the soil is cultivated without mixing its layers, and plant residues are used to mulch it. After the nut orchard is planted, it is sown with perennial green manure plants to preserve moisture and to counteract soil washout in the event of heavy rains and cultivated plants rich in microelements necessary for nuts are planted in the aisles.

Educational and advisory services on climate adaptation and greening are provided primarily by non-governmental organizations (NGOs) and Ukrainian agricultural educational institutions (which are mainly focused on future farmers who are still students of these institutions).

Examples of the involvement of NGOs and other organizations in the dissemination of knowledge on climate adaptation and the greening of Ukrainian agriculture include, in particular, the regular organization of relevant meetings, conferences, roundtables, etc. with the participation of farmers and other stakeholders, the publication of brochures and other materials on the subject, consultancy services, etc. For example, the BTU Soil Health Platform carries out educational activities on soil fertility issues and their revitalization technologies, that is known to be related to climate adaptation in agriculture. In 2023-2024, BTU Soil Health hosted conferences entitled 'National Challenge: Soil Degradation or Soil Fertility Restoration?[61]. The discussion focused on soil degradation and war, European integration, climate change, research, and practical recommendations for adaptation to climate and environmental challenges.

NGO Ecodia's educational and advisory activities are aimed, in particular, at reducing the negative impact of agricultural activities on the environment through the introduction of modern environmental standards and adaptation of agriculture to negative climate impacts[62]. This NGO publishes materials on the use of precision farming technologies, the development of field biosecurity systems, etc., conducts research on sustainable land management at the community level, and holds webinars, in particular on the experience of Latvia and Poland in implementing the Nitrate Directive, etc.[63]

The Law of Ukraine "On Agricultural Advisory Activity" defines the duty of the National Association of Agricultural Advisory Services of Ukraine (NAAASU) to provide advisory services to agricultural entities and the rural population on issues of economics, technology, management, marketing, ecology, as well as the dissemination and implementation of modern technologies, the latest achievements of science and technology in production[64]. The NAAASU is represented in all regions of Ukraine by agricultural advisory entities that provide advisory services, including to agricultural producers, as part of various projects. For example, within the framework of the German Ukrainian agri-political dialogue APD, training programmes on sustainable development were developed, and a project to support the dissemination of best sustainable practices for micro, small, and medium-sized agricultural enterprises was implemented with the support of USAID, etc.[65].

The country's research institutions are also contributing to the dissemination of knowledge on the possibilities of effective adaptation of Ukraine's agricultural sector to the growing climate change. Thus, in 2024, the National Institute for Strategic Studies and the Institute of Climate-Smart Agriculture of the National Academy of Agrarian Sciences of Ukraine

[58] Solar farming – the future of Ukrainian agribusiness. https://www.seeds.org.ua/sonyachne-fermerstvo-majbutnye-agrobiznesu-ukraini/

[59] Organic raspberries from the Rivne region of the European standard. http://www.jagodnik.info/organichna-malyna-z-rivnenshhyny-yevropejskogo-zrazka/

[60] For the first time in Ukraine, a closed-cycle organic nut production facility has been set up. https://www.instagram.com/p/DGKzOQCCtAX/?img_index=1

[61] The national challenge: Soil degradation or restoration of soil fertility? https://soil.btu-center.com/conference

[62] Adaptation to climate change. https://ecoaction.org.ua/diyalnist/klim-adaptacia

[63] Agriculture. https://ecoaction.org.ua/diyalnist/agriculture

[64] The Law of Ukraine "On Agricultural Advisory Activities". https://zakon.rada.gov.ua/laws/show/1807-15#Text

[65] The role of extension services in promoting sustainable practices in agriculture. https://agrovolyn.gov.ua/sites/default/files/attachments/roman-korinec_prezentaciya-proon-gef-27.06.2023.pdf

organized a roundtable discussion on 'Prospects for the development of Ukraine's agricultural sector in the context of climate change'[66]. In particular, it presented the work of scientists on adapting the agricultural sector to negative climate impacts.

Ukrainian higher and vocational education and training institutions of the agrarian orientation pay considerable attention to teaching issues related to the greening of agricultural activities and their adaptation to climate change in their curricula. This forms the basis for enhancing future farmers' understanding of climate change and developing their skills in applying adaptation technologies that reduce vulnerability to climate change.

The All-Ukrainian Association of Amalgamated Territorial Communities confirmed the importance of implementing measures to adapt Ukrainian agriculture to climate change at the local level and outlined its role in this process, in particular in helping communities to develop appropriate adaptation programmes[67].

d) Selection of varieties of climate-resistant plants and seedlings

An important factor in the success of horticulture is planting material (seedlings), which must be of high quality (which affects the condition and health of perennial plantations, their yield, and the quality of products) and have a legal origin to ensure the most favorable conditions for sale. The use of high-quality seedlings of highly productive varieties is one of the main factors in increasing the potential for adaptation of fruit and berry plantations to climate change, as well as intensifying crop production.

The state of seedling production. As of 2021, 73 farms, including 2 scientific institutions, were engaged in the cultivation of certified planting material for fruit and berry crops in Ukraine. In 2020, they grew certified seedlings of zoned varieties in all nurseries: fruit - 4026.88 thousand units, bush berries - 4056.44 thousand units, nut-bearing - 1147 thousand units, strawberries - 8.5 million units[68]. The crisis in the nursery sector, caused by imperfect legislation, namely, the inconsistency of the Law of Ukraine "On Seeds and Planting Material" with the requirements of the nursery industry, as its amendments at that time concerned plants that reproduce generatively (grain crops), without considering the requirements for horticulture, viticulture and hop growing. It is confirmed by a 3.3-fold decrease in the number of nursery farms between 2011 and 2021 (from 241 in 2011 to 73 in 2021) and, accordingly, the production of fruit and grape seedlings decreased by more than 6 times over the same period.

A significant proportion of seedlings are produced in non-specialized farms (individual farms, private households, etc.), which are not equipped with the necessary material resources, do not have the appropriate specialists, and do not pay taxes to local budgets. In addition, they are difficult to control for varietal affiliation, phytosanitary condition of plantations, and compliance with agrotechnical measures and techniques. This leads to an uncontrolled circulation of planting material grown outside the certification scheme from seedlings of uncertain origin.

Regulation of seedling production in Ukraine. The production and sale of seeds and planting material are regulated by the Law of Ukraine "On Seeds and Planting Material"[69]. Commercial, economic, organizational and legal relations in the industry are regulated by the Law of Ukraine "On Amendments to Certain Laws of Ukraine on Bringing the Legislation of Ukraine in the Seed and Seedling Production Sector in Compliance with European and International Norms and Standards"[70], "On Amendments to Certain Legislative Acts of Ukraine on Bringing Legislation in the Field of Plant Variety Rights Protection and Seed and Seedling Production in Compliance with the Provisions of the European Union

[66] Prospects for the development of Ukraine's agricultural sector in the context of climate change. https://niss.gov.ua/news/novyny-nisd/perspektyvy-rozvytku-ahrarnoho-sektoru-ukrayiny-v-umovakh-klimatychnykh-zmin

[67] All-Ukrainian Association of Amalgamated Territorial Communities. The role of ATCs in the implementation of measures to adapt Ukrainian agriculture to climate change at the local level. https://hromady.org/%D1%80%D0%BE%D0%BB%D1%8C-%D0%BE%D1%82%D0%B3-%D0%B2-%D1%96%D0%BC%D0%BF%D0%BB%D0%B5%D0%BC%D0%B5%D0%BD%D1%82%D0%B0%D1%86%D1%96%D1%97-%D0%B7%D0%B0%D1%85%D0%BE%D0%B4%D1%96%D0%B2-%D0%B7-%D0%B0%D0%B4%D0%B0/

[68] Concept of Seedling Development in Ukraine for the period up to 2025. https://ukrsadprom.org/wp-content/uploads/2021/03/Kontseptsii-rozvytku-rozsadnytstva_compressed.pdf

[69] The Law of Ukraine "On Seeds and Planting Material" of 26.12.2002 No. 411-IV. https://zakon.rada.gov.ua/laws/show/411-15#Text

[70] The Law of Ukraine "On Amendments to Certain Laws of Ukraine on Bringing the Legislation of Ukraine in the Field of Seed Production and Seedling in Compliance with European and International Norms and Standards" of 08.12.2015 No. 864-VIII. https://zakon.rada.gov.ua/laws/show/864-19#Text

Legislation"[71], "On Protection of Plant Variety Rights"[72], "On the State System of Biosafety in the Creation, Testing, Transportation and Use of Genetically Modified Organisms"[73], as well as a number of Resolutions of the Cabinet of Ministers of Ukraine and orders of central executive authorities.

In accordance with the Law of Ukraine "On Seeds and Planting Material" and the Certification Procedure, the grown planting material sold in Ukraine and used for economic purposes must be certified. Certification is possible only if the planting material belongs to a variety listed in the Register of Plant Varieties of Ukraine and meets the requirements of the legislation in the field of seed production and nursery. The State Register of Plant Varieties Suitable for Distribution in Ukraine includes the vast majority of varieties of fruit, berry, and nut crops developed at the Institute of Horticulture of the National Academy of Sciences of Ukraine and other scientific institutions of the country. As of July 2024, the register included 91 varieties of apple trees, including 24 of domestic origin; 83 varieties of strawberries, including 7 of domestic origin; 46 varieties of raspberries, including 5 of domestic origin; and 42 varieties of walnuts, including 22 of domestic origin.

Article 1 of Section I of the Law of Ukraine "On Seeds and Planting Material" defines the categories and requirements for planting material of perennial plants. In 2016, the Law was amended to require that planting material be virus-free, which allows for better control of the phytosanitary condition, in particular in industrial plantations. Before the war, the share of virus-free planting material in the Ukrainian nursery industry was as follows, %: pome crops - 5.7, stone fruit - 6.8, nut crops - 1.2, bush berries - 15.6, strawberries - 41.1. However, according to the amendments to the Law, 100% of industrial fruit and berry plantations in Ukraine must be planted with healthy, virus-free planting material.

The current legal and regulatory framework for the market of planting material in Ukraine is characterized by imperfections in the existing legal norms and a lack of effective mechanisms for their application. Currently, the legal framework for seed production has been adapted to international norms and standards, and state standards for seeds have been changed. At the same time, the provisions of the current Law of Ukraine "On Seeds and Planting Material" do not meet the requirements of the seedling industry, as the amendments concerned plants that reproduce generatively (grain crops), without taking into account the requirements for horticulture, viticulture, and hop growing.

In particular, the Law of Ukraine "On Seeds and Planting Material" needs to be brought in line with international requirements for the definition of categories of planting material for fruit, berry, nut crops, grapes and hops (pre-basic material, basic material, certified material, CAC (Conformitas Agraria Communitatis) material), phytosanitary status (virus-free, virus-tested), and other terms and definitions related to seedling production; implementation of the EU Council Directives for planting material of the listed crops and categories (Council Directive 2008/90/EC of 29 September 2008 concerning the marketing of planting material for fruit plants and fruit plants for fruit production[74], Council Directive 68/193/EEC of 9 April 1968 concerning the marketing of material for the vegetative propagation of grapes[75], Council Directive 2002/11/EC of 14 February 2002, amending Directive 68/193/EEC concerning the marketing of material for the vegetative propagation of grapes and repealing Directive 74/649/EEC[76]), which regulate the conduct of nursery farming in the European Union; certification of the commercial qualities of planting material by the relevant accompanying document of the producer instead of the certification procedure with the issuance of a certificate by the central executive authority. This inconsistency calls into question the quality of planting material grown in Ukraine.

Ukraine has developed a draft Law of Ukraine "On Perennial Plant Nursery" aimed at regulating the industry engaged in the propagation of perennial plants by vegetative means, the provisions of which were recommended to be taken into account by amending the Law of Ukraine "On Seeds and Planting Material", which has not yet been done.

[71] The Law of Ukraine "On Amendments to Certain Legislative Acts of Ukraine on Bringing the Legislation on Protection of Plant Variety Rights and Seed and Seedling Production in Line with the Provisions of the European Union Legislation" of 16.11.2022 No. 2763-IX https://zakon.rada.gov.ua/laws/show/2763-20#Text

[72] Law of Ukraine "On Protection of Rights to Plant Varieties" of 21.04.1993 No. 3116-XII, https://zakon.rada.gov.ua/laws/show/3116-12#Text

[73] The Law of Ukraine "On the State System of Biosafety in the Creation, Testing, Transportation and Use of Genetically Modified Organisms" of 31.05.2007 No. 1103-V, https://zakon.rada.gov.ua/laws/show/1103-16#Text

[74] Council Directive 2008/90/EC of 29 September 2008 on the marketing of fruit plant propagating material and fruit plants intended for fruit production

[75] Council Directive 68/193/EEC of 9 April 1968 on the marketing of material for the vegetative propagation of the vine

[76] Council Directive 2002/11/EC of 14 February 2002 amending Directive 68/193/EEC on the marketing of material for the vegetative propagation of vines and repealing Directive 74/649/EEC

The varieties developed are adapted to the climatic conditions of a particular region, as some varieties are better able to cope with cold winters and frosts, while others are more resistant to heat and drought. Traditional and local varieties that are well adapted to local conditions and prove to be productive are important. Both European and Ukrainian plant breeders are developing new varieties of plants that are more resistant to temperature extremes and water shortages or excesses. Adaptive plants are distinguished by their flexibility, effectively adapting to various agro-climatic conditions, guaranteeing stable development regardless of environmental challenges, are able to maximize their yield potential, and also require less herbicides and fertilizers.

e) Soil management as a basis for ensuring the climate adaptation of crop production

Positioning the importance of good soil health for decarbonization and climate neutrality is a new trend under the European Green Deal (EGD) of 2019. The Farm to Fork Strategy of 2020, which is defined as central to the EGD, sets a target to reduce soil nutrient loss by at least 50% while preventing soil fertility degradation[77]. The 2021 EU Soil Strategy, Delivering the benefits of healthy soils for people, food, nature and climate[78], aims to achieve zero increase in land degradation by 2030 and declares that soil protection and management, and restoration of degraded soils, is a common standard.

In Ukraine, almost 16 million hectares of agricultural land were eroded before the war, i.e., 38% (20% were severely degraded, the rest is under threat, according to FAO estimates[79]); over the past 10 years, Ukrainian lands have lost 30% of their humus. Annual losses from the main types of soil degradation amounted to about UAH 40-50 billion[80] due to the loss of humus and nutrients, soil and a shortfall in agricultural production (a 25% reduction in productivity). For comparison, in the EU, 12.7% of soils suffer from erosion (moderate to high).

As a result of the Russian invasion and large-scale hostilities, 16 million hectares are at risk of explosive contamination, and it will cost USD 12.8-26.6 billion to clear Ukrainian agricultural land[81]. Due to the hostilities and mining of the territory, in 2022, agricultural producers could not use about 30% of the fields for sowing (which reached 5 million hectares); in 2023, 25% of the sown areas were unusable[82].

As for losses and damages in the ***fruit and berry sector***, researchers estimate that the war led to the loss of 16.3 thousand hectares of perennial plantations (direct losses) with an estimated cost of restoration of USD 398 million. The total estimate of indirect losses for the three years of decline in berry crops and five years of decline in pome and stone fruit crops is USD 769 million, while the annual decline in perennial crops is estimated at 458 thousand tons[83].

The regulatory and legal documents of Ukraine on soil management to ensure climate adaptation of crop production, approved in 2019-2024, in Annex 2.

The Strategy for the Development of Agriculture and Rural Areas in Ukraine until 2030 of 2024 defines Strategic Objective 4. Efficient use of land: demining, land reform, under which objective 2 aims to promote sustainable development and efficient use of soil, air and

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[77] Communication from the Commission to the European Parliament, the Council, the European economic and social Committee and the Committee of the Regions. A Farm to Fork Strategy for a fair, healthy and environmentally friendly food system Contents. European Commission. Brussels, 20.5.2020 COM (2020) 381 final. https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52020DC0381.

[78] Communication from the Commission to the European Parliament, the Council, the European economic and social Committee and the Committee of the Regions EU Soil Strategy for 2030 Reaping the benefits of healthy soils for people, food, nature and climate. URL: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52021DC0699.

[79] The war is significantly worsening the situation with soil degradation. 09 December 2022. https://agroportal.ua/news/ukraina/viyna-znachno-pogirshuye-situaciyu-z-degradaciyeyu-gruntiv

[80] Order of the Cabinet of Ministers of Ukraine of 19 January 2022 No. 70 "On Approval of the Concept of the National Target Programme for Land Use and Protection". URL: https://zakon.rada.gov.ua/laws/show/70-2022-%D1%80#Text.

[81] Prospects for the development of the agrarian sector of Ukraine in the context of climate change: analytical report / [V.M. Rusan, L.A. Zhurakovska, Y.A. Zhalilo et al. C. 16. https://niss.gov.ua/sites/default/files/2024-07/ad_klimagrosektor_03_07_24_zminena.pdf.

[82] Reconstruction for Development: Foreign Experience and Ukrainian Prospects: an international collective monograph. Kyiv, 2023. 571 c. URL: http://ief.org.ua/wp-content/uploads/2023/08/Reconstruction-for-development.pdf.

[83] Neyter, Roman; Zorya, Sergiy; Muliar, Oleksandr. Damage, losses and needs of agriculture due to full-scale invasion (Ukrainian). Washington, D. C.: World Bank Group. C. 10, 14. https://kse.ua/wpcontent/uploads/2024/02/RDNA3_ukr.pdf.

water, including by reducing dependence on chemicals[84]. The summary of this objective contains two provisions: sustainable management of natural resources is a key priority, and the necessary minimum requirements for producers to comply with good agricultural and environmental conditions (GAEC) should be defined. In order to enable producers to maintain GAEC, the necessary minimum requirements should be defined based on the experience of EU Member States, taking into account the specific characteristics of the respective areas, including soil and climatic conditions, existing farming systems, land use, crop rotation, farming practices and farm structures Annex 3. It should be noted that this is the first time that a strategic act of Ukraine has identified the need to regulate GAEC, which have been used for a long time in the EU, and this provision should be detailed in the regulatory documents for the implementation of the Strategy.

The main measures to develop the norms laid down in the current legislation of Ukraine aimed at achieving climate goals in the land use sector include the following:

- to implement the declared norms for reducing agricultural development by 5% and ploughing the territory by 10% by 2030, it is necessary to regulate the reimbursement to landowners of the costs of organizational and practical work on the conservation of degraded, low-productive, technogenically polluted lands (in particular, ordering a conservation project, conducting necessary surveys, investigations, etc.), and it is also necessary to provide support to agricultural producers when they carry out reclamation, reforestation or renaturalization of conserved lands, financial compensation for their lost profits (from the refusal to grow crops for sale on lands designated for conservation);
- to regulate the proper implementation of the legislatively declared goal of achieving a neutral balance of degradation of Ukrainian lands by 2032, in addition to the envisaged allocation of degraded lands for conservation;
- administer and encourage crop rotation, promote no-till farming, sustainable practices such as precision agriculture, agroecology, agroforestry, low-intensity permanent hayfields and pastures, and organic farming;
- to regulate and support the large-scale transition of agricultural producers to good agricultural practices common in the European Union in order to preserve natural agricultural resources, especially land, and the environment;
- to regulate the minimum requirements for producers to comply with good agricultural and environmental conditions (GAEC), as set out in the Strategy for the Development of Agriculture and Rural Areas in Ukraine until 2030 of 2024, as a basic condition for providing them with budget support under any state programmes for agricultural producers. This would be in line with the “enhanced conditionality” approach to farmers applying for financial support under the EU’s Common Agricultural Policy.

f) Regulation of organic agricultural production

The production of organic products meets the needs of modern consumers who prioritize health, environmental, and ethical aspects of food production. In this regard, in the pre-war period, organic production in Ukraine developed rapidly.

The development and support of the organic sector, quality assurance of organic products, and consumer protection are regulated by national organic legislation. In 2018, the Law of Ukraine “On Basic Principles and Requirements for Organic Production, Circulation and Labelling of Organic Products”[85] was adopted, which took into account the main key provisions of the EU Regulations in force at that time. This law has now been fully implemented, as all 11 bylaws have been adopted. Thus, Ukrainian legislation in the field of organic production is already fully operational. In 2023, two state registers in the field of organic production, circulation, and labe ling of organic products were launched and the first domestic certification body, Organic Standard, was established.

On 1 January 2022, the new Regulation (EU) No 2018/848 of the European Parliament and of the Council on organic production and labelling of organic products came into force in the EU[86]. The structure of the new EU organic legislation is not a separate Regulation,

[84] Draft Strategy for the Development of Agriculture and Rural Areas in Ukraine for the period up to 2030 of 2024: https://minagro.gov.ua/npa/stratehiia-rozvytku-silskoho-hospodarstva-ta-silskykh-terytorii-v-ukraini-na-period-do-2030-roku

[85] On the basic principles and requirements for organic production, circulation and labelling of organic products: Law of Ukraine of 10.07.2018 No. 2496-VIII. Bulletin of the Verkhovna Rada of Ukraine. 2018, No. 36, Art. 275.

[86] Regulation (EU) 2018/848 of the European Parliament and of the Council of 30 May 2018 on organic production and labelling of organic products and repealing Council Regulation (EC) No 834/2007. OJ L 150, 14.6.2018, p. 1-92.

but an integrated system of organic legislation. Whereas previously the system consisted of several regulations, the new legislation groups all legal acts according to the sections of the main regulation, namely: production rules, plant reproductive material and seeds, control, trade with third countries, etc. The new amendments came into force in January 2022, so Ukraine should already take them into account when formulating its state policy on organic production.

The new system provides for several innovations, including: strengthening the control system for the production of organic products through the application of stricter precautions and inspections of the entire supply chain; simplifying the certification procedure for small farmers through the introduction of a new group certification system; introducing new rules for the import of organic products into the EU; and covering a wider range of products under organic rules.

The Regulation focuses on the environmental and climate-friendly characteristics of this practice, in particular, it states that organic production is a general farm and food production management system that combines the best practices of environmental and climate action. It also points out that seedlings are one of the factors of adaptation to climate change, namely: "organic crop production systems require plant reproductive material that can provide disease resistance and adapt to a variety of local soil and climatic conditions".

Also, in Article 6 of the Regulation, among the principles of agricultural organic activity, there is a provision relating to adaptation to climate change and greening, namely: when selecting plant varieties, take into account the characteristics of specific organic production systems, agronomic efficiency, disease resistance, potential for adaptation to various local soil and climatic conditions and specific practices of organic agriculture.

The Common Agricultural Policy regulates the right of organic farmers to payments under the provisions of Regulation (EU) No 1307/2013 laying down rules for direct payments to farmers under CAP support schemes and Regulation (EU) No 1305/2013 of the European Parliament and of the Council of 17 December 2013 on support for rural development by the European Agricultural Fund for Rural Development.

In Ukraine, according to the current law, no support is provided to operators under state programmes at the expense of state budget expenditures, only the possibility of providing such support is declared.

g) Use of pesticides and mineral fertilizers, and rules for controlling pests, plant diseases, and invasive species

Pesticides. In Ukraine, the average annual crop losses from pests, diseases, and weeds are 20-30%, including 48% of fruit crops[87]. These losses include reduced yields due to weeds suppressing crops and damage by pests and diseases. Pesticides are used to reduce such losses.

Ukrainian legislation on pesticide use consists of the Laws of Ukraine "On Pesticides and Agrochemicals"[88] and "On Plant Protection"[89] and a number of departmental orders. In particular, Ukraine has the following State Sanitary Rules and Regulations DSanPiN 8.8.1.2.3.4-000-2001 Permissible Doses, Concentrations, Amounts and Levels of Pesticides in Agricultural Raw Materials, Foodstuffs, Work Area Air, Ambient Air, Water, and Soil[90], where Annex 2 contains 424 names of active substances; Annex 2.2 contains pesticides prohibited for use in agriculture (87 names of active substances); Annex 3 contains the List of pesticides and agrochemicals, registration of which in Ukraine is approved by the Chief State Sanitary Doctor of Ukraine, and regulations for their use subject to state sanitary and epidemiological supervision.

In addition, the Ministry of Environmental Protection and Natural Resources of Ukraine has developed draft laws: "On Plant Protection Products and Fertilizers"[91] (submitted to

[87] Justification for the use of pesticides (plant protection products). https://hth.gov.ua/news/1710843508/

[88] Law of Ukraine "On Pesticides and Agrochemicals". https://zakon.rada.gov.ua/laws/show/86/95-%D0%B2%D1%80#Text

[89] The Law of Ukraine "On Plant Protection". https://zakon.rada.gov.ua/laws/show/180-14#Text

[90] State Sanitary Rules and Norms DSanPiN 8.8.1.2.3.4-000-2001. https://zakon.rada.gov.ua/rada/show/v0137588-01#Text.

[91] Draft Law on Plant Protection Products and Fertilizers. URL: https://itd.rada.gov.ua/billInfo/Bills/Card/43799. This draft law provides that all pesticide registrations in force as of the date of entry into force of this Law in accordance with the Law of Ukraine "On Pesticides and Agrochemicals" remain valid until the expiry of the registration period without the need to approve the active substance of the antidote or synergist that is part of the formulation. The following laws of Ukraine are also amended: 1) On Plant Protection, On the List of Permitting Documents in the Field of Economic Activity, On Licensing of Economic Activities. This law brings the procedure for registration of pesticides and agrochemicals in Ukrainian legislation in line with EU procedures.

the VRU in March 2024) and “On Placing Plant Protection Products and Agrochemicals on the Market”. The Ministry’s website also contains the State Register of Pesticides and Agrochemicals Permitted for Use in Ukraine[92]. This register contains more than 3,500 names of products for the protection of all types of crops. Plant protection products (PPPs) that are not included in this list are not allowed to be used.

The volumes of plant protection products used in Ukraine have changed from time to time. Thus, in the 1990s, there was a reduction in their use[93]. In particular, while in 1991 the average pesticide load was 2.7 kg/ha, in 1995 it was 1.1 kg/ha, in 1997 it was 0.7 kg, and in 2000 this figure decreased to 0.4 kg/ha. However, in 2018-2019, according to the State Statistics Service of Ukraine, this figure increased to 1.3-1.4 kg/ha (pesticides in active substance). The pesticide burden is particularly high when intensive technologies are used. For example, when growing fruit crops, the pesticide load can sometimes increase up to 165 kg/ha.

Official data indicate certain positive processes in the use of plant protection products, namely an increase in the area of pesticide application while reducing the volume of pesticide application per hectare amid a general trend of increasing the volume of pesticide application for crops. 2022 was extremely difficult for gardeners, as evidenced by a significant decrease in the intensity of pesticide use. Currently, the share of the area under pesticide application has increased, and the specific volumes of pesticide application have also increased.

It is worth noting the complete lack of information on the use of pesticides by households in gardens and berry fields and the corresponding lack of control over this process. Given the high share of such farms in the production of fruit and berry products, this situation poses risks to product safety in the domestic market of Ukraine, the environmental situation in the country and also reduces export prospects.

The pesticide market in Ukraine is highly import-dependent. This was especially noticeable in the pre-war period. Thus, in 2017-2018, Ukraine produced only slightly more than 8% of the plant protection products used during the year, while the rest was imported[94]. At the same time, almost half of the imports were carried out by 5 transnational corporations (Syngenta, Basf, Adama Agricultural Solutions Ltd, Bayer and Monsanto). The war and the disruption of logistical networks for agricultural producers, including those involved in importing plant protection products, have reshaped the Ukrainian market. For example, in 2022, for the first time, the share of all multinational companies on the market decreased to 47%[95].

It is also worth noting that a large number of counterfeit products enter the Ukrainian pesticide market. It is estimated that the share of counterfeit products is 20-30% of the market volume, and the number of fake products intended for retail sale to the public exceeds 50%[96].

Rules for controlling pests and diseases of plantations and invasive species.

As noted above, the Ukrainian legislation on pesticide use consists of the Laws “On Pesticides and Agrochemicals” and “On Plant Protection”, as well as departmental orders, the main ones being the State Sanitary Rules of the Ministry of Health of Ukraine, approved by Order No. 1 of 03.08.98 “Transportation, Storage and Use of Pesticides in the National Economy”[97], “State Sanitary Rules for Aviation Application of Pesticides and Agrochemicals in the National Economy of Ukraine”[98], approved by the Order of the Ministry of Health of Ukraine of 18.12.96 No. 382, etc.

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[92] State Register of Pesticides and Agrochemicals Permitted for Use in Ukraine. https://mepr.gov.ua/upravlinnya-vidhodamy/derzhavnyj-reyestr-pestytsydiv-i-agrohimikativ-dozvolenyh-do-vykorystannya-v-ukrayini/

[93] Statistics on the use of plant protection products in Ukraine and the world are published. https://superagronom.com/news/13330-opublikovano-statistiku-vikoristannya-zzr-v-ukrayini-ta-sviti

[94] Stankevych S.V. The pesticide market of Ukraine: a monograph / S.V. Stankevych: Ivanchenko Publishing House, 2020. 175 p.

[95] AHT: in 15 years, a local pesticide producer becomes a powerful Ukrainian brand. https://www.epravda.com.ua/publications/2023/10/24/705752/

[96] State regulation of the pesticide market. A course to restore order. https://agropolit.com/cards/8-derjavne-regulyuvannya-rinku-pestitsidiv-kurs-na-navedennya-ladu

[97] State Sanitary Regulations "Transportation, Storage and Use of Pesticides in the National Economy" DSanPiN 8.8.1.2.001-98. https://dnaop.com/html/32151/doc-%D0%94%D0%A1%D0%9F_8.8.1.2.001-98

[98] State sanitary rules for the aerial application of pesticides and agrochemicals in the national economy of Ukraine. https://mozdocs.kiev.ua/view.php?id=4155.

Enterprises, institutions, and organizations are required to keep records of the availability and use of pesticides following the Procedure for State Accounting of the Availability and Use of Pesticides and Agrochemicals[99] . Currently, the only access to the Ukrainian market is through the pesticide registration procedure, and their use requires a Pesticide Work Permit[100].

In order to avoid negative consequences of the use of pesticides and agrochemicals for people and the environment, the rules for their use in Ukraine (in addition to the above) contain, inter alia, provisions on the need to: treat plants and orchards when the number of pests or the development of a disease exceeds the economic threshold of harmfulness, taking into account the biological characteristics of the crop and pests and in optimal terms; use only recommended pesticides; comply with the sanitary zone when applying plant protection products.[101]

Invasive species mean an alien species whose introduction or spread has been found to threaten or adversely impact upon biodiversity and related ecosystem services[102]. In other words, invasive species are plant and animal species that are alien to a particular area and are actively reproducing, occupying new territories, and displacing native species. Thus, they significantly change ecosystems and deplete their biodiversity[103].

The negative impact of invasive plant species is manifested in the fact that they are excessive consumers of moisture and nutrients, have allopathic properties (inhibit the growth of native plant species), deplete the soil, cause its erosion, and successfully compete for pollinators. Adverse effects of climate change (droughts, heavy rains, etc.) increase the vulnerability of agricultural plantations to invasive pathogens. Researches show that the introduction of invasive organisms in Ukraine may accelerate significantly due to global climate change[104].

Among invasive weed species, ragweed, Syrian cottonweed, Canadian goldenrod, etc., pose a great danger in Ukraine[105]. As alien species, these plants do not meet any 'enemies' either among local competitors or insects. In addition, they produce a huge number of seeds that have a very high germination rate (up to 95%), and the roots of such plants, as noted, release certain organic compounds that can inhibit the growth of native species. In addition, invasive pest and weed species are better adapted to high temperatures and are highly drought-resistant, which creates additional conditions for their aggressive spread.

Climate change, in particular the rise in air temperature, is also contributing to the spread of dangerous invasive pests in Ukraine, including the American white butterfly (particularly threatening to apple trees and walnuts), the Asian harmony (causing significant damage to apple trees, grapes, etc.), the white cicada (dangerous, in particular, to raspberries), and others.

The Strategy for Biosafety and Biological Protection adopted by Ukraine in 2021[106] outlines the need to establish an effective mechanism for dealing with invasive alien species, namely, to prevent their introduction, control their penetration into natural ecosystems, and remove and mitigate (minimize) their negative impacts. In the absence of such a mechanism, there is a possibility of rapid and uncontrolled spread of invasive species in Ukraine in the context of ongoing climate change.

In international legislation, the need to take measures to address the threats posed by biological invasions is stipulated in: UN Convention on Biological Diversity (Rio de Janeiro,

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[99] Resolution of the Cabinet of Ministers of Ukraine of 2 November 1995, No. 881 "On Approval of the Procedure for State Accounting of Availability and Use of Pesticides and Agrochemicals". https://zakon.rada.gov.ua/laws/show/881-95-%D0%BF#Text

[100] CMU Resolution of 9 May 2023 No. 458 "On Approval of the Procedure for Obtaining a Certificate of the Right to Work with Pesticides". https://zakon.rada.gov.ua/laws/show/458-2023-%D0%BF#Text.

[101] Rules for the use of pesticides and agrochemicals in agriculture. https://himagro.com.ua/ecology/pravyla-zastosuvannia-pestycydiv

[102] Regulation (EU) No 1143/2014 of the European Parliament and of the Council of 22 October 2014 on the prevention and management of the introduction and spread of invasive alien species. https://eur-lex.europa.eu/eli/reg/2014/1143/oj/eng

[103] Invasive species of pests in Ukraine. https://propozitsiya.com/ua/invaziyni-vydy-shkidlyvyh-organizmiv-v-ukrayini

[104] Matsiakh, I. (2021). Invasive alien pathogens as a threat to global biodiversity. https://doi.org/https://doi.org/10.15421/412101

[105] Plants that should not be grown on a personal plot: invasive species. https://www.rivneprod.gov.ua/2020/03/27/roslyny-yaki-ne-varto-vyroshhuvaty-na-prysadybnij-dilyantsi-invazijni-vydy/

[106] The Strategy for Biosafety and Biological Protection. https://www.rnbo.gov.ua/ua/Ukazy/5190.html

1992[107]); Bern Convention on the Conservation of Wild Flora and Fauna (Bern, 1979[108]); Convention on Wetlands (Ramsar 1971, Paris 1982[109]); some recommendations under the Convention on International Trade in Endangered Species of Wild Flora and Fauna (Washington, 1973[110]). The EU also has Regulation (EU) No 1143/2014 of the European Parliament and of the Council of 22 October 2014 on the prevention and management of the introduction and spread of invasive alien species[111], which is the main legislative act in this area. Although each EU country has its own list of invasive species, there is also a common European list posted on the official website of the European Commission.

In Ukraine, the issue of combating invasive species has become more urgent in recent years, while until 2021, there was no comprehensive approach to addressing this issue[112]. At the initiative of the Ministry of Environment , the Strategy for Biosafety and Biological Protection[113] and the Action Plan for its implementation was approved[114], as amended, as well as in July 2024, a draft law on combating invasive species was presented. This document aims to create a legislative framework for effective regulation of the management of alien species. The draft law provides for amendments to a number of legislative acts to counter the invasion of invasive species, control their spread, and stop or mitigate the impact of invasive alien species on the environment, native species, biodiversity, economy, and human health.

Thus, the process of harmonizing Ukrainian legislation with European legislation in terms of combating the spread of invasive plant and animal species is developing, although it is still at the initial stage.

Fertilizers. ***Legal regulation of fertilizer uses in agriculture in Ukraine.*** There has been a growing interest in analyzing the use of fertilizers for growing crops since the EU's Farm to Fork Strategy was published in May 2020 as part of the EGD, which sets out to reduce nutrient losses by 50%, preserve soil fertility and reduce fertilizer use by at least 20% by 2030. *The current documents of Ukraine do not declare a reduction in the use of mineral fertilizers.* The Law of Ukraine "On Pesticides and Agrochemicals" of 1995, No. 86, in its Article 12, defines the procedure for the use of pesticides and agrochemicals. The Concept of the National Targeted Programme for Land Use and Protection (Order of the Cabinet of Ministers of Ukraine No. 70 of 2022) states that the expected results include an increase in the productivity of agricultural land (by 40-50%) through the rational use of organic, organo-mineral and mineral fertilizers and chemical ameliorants. However, the Cabinet of Ministers' Decree "On Approval of the Strategy for Environmental Security and Climate Change Adaptation for the Period up to 2030" of 2021 No. 1363 does not provide for the use of fertilizers in agriculture. The draft Recovery Plan of Ukraine in the section "Environmental Security" includes task 9 - assessing the vulnerability of economic sectors to climate change and preparing adaptation plans. When conducting assessments and preparing adaptation measures for agriculture, fertilizers and their impact on climate should be considered.

The documents on Ukraine's Updated Nationally Determined Contribution to the Paris Agreement (NDC2) envisage achieving GHG emission reductions through, among other things, the use of slow-release nitrogen fertilizers[115]. However, the list of measures in the NDC2 does not include such an important climate change mitigation measure as organic fertilizer management.

[107] Ratified by Ukraine in 1994, entered into force in 1995 (see Convention on Biological Diversity of 1992. https://zakon.rada.gov.ua/laws/show/995_030#Text)

[108] Ukraine joined in 1996 (see Convention on the Conservation of European Wildlife and Natural Habitats. https://zakon.rada.gov.ua/laws/show/995_032#Text)

[109] Entered into force for Ukraine in 1997 (see Convention on Wetlands of International Importance especially as Waterfowl Habitat. https://zakon.rada.gov.ua/laws/show/995_031#Text)

[110] Ukraine joined in 1999 (see Convention on International Trade in Endangered Species of Wild Flora and Fauna. https://zakon.rada.gov.ua/laws/show/995_129#Text)

[111] Regulation (EU) No 1143/2014 of the European Parliament and of the Council of 22 October 2014 on the prevention and management of the introduction and spread of invasive alien species. https://eur-lex.europa.eu/eli/reg/2014/1143/oj.

[112] The Ministry of Ecology has approved a list of alien tree species banned from forest reproduction. https://mepr.gov.ua/mindovkillya-zatverdylo-perelik-chuzhoridnyh-vydiv-derev-zaboronenyh-u-vidtvorenni-lisiv/

[113] Decision of the NSDC of Ukraine of 15 October 2021 "On the Strategy of Biosafety and Biological Protection"

[114] CMU Order of 7 July 2022 No. 573-p "On Approval of the Action Plan for the Implementation of the Strategy for Biosafety and Biological Protection for 2022-2025". https://zakon.rada.gov.ua/laws/show/573-2022-%D1%80#Text.

[115] Policies and measures to prevent climate change (to Report 4) (for discussion): https://mepr.gov.ua/files/images/news_2020/22122020/%D0%BF%D0%BE%D0%BB%D1%96%D1%82%D0%B8%D0%BA%D0%B8%20%D1%82%D0%B0%20%D0%B7%D0%B0%D1%85%D0%BE%D0%B4%D0%B8.pdf

Official statistics on fertilizer use. The level of mineral fertilizer use by agricultural enterprises for perennial crops in Ukraine exceeds their application for all crops: 153 kg was applied per hectare of fertilized area in 2023, compared to 122 kg in the previous year.

In 2023, the use of mineral and organic fertilizers decreased compared to pre-war 2021; only half (50.8%) of the area under perennial crops was fertilized, and 87% of all crops were fertilized.

The State Statistics Service of Ukraine provides data on the use of fertilizers for crops:

- only for enterprises. Households engaged in agriculture and making a significant contribution to the production of fruit and berry products remain outside the statistical record;
- in general, for perennial crops (including fruit and berries, nuts, grapes, hops, etc.), which "smoothes out" the rate of fertilizer use for fruit and berry crops.

Therefore, it *is necessary to provide statistical information on fertilizer application with a breakdown of fruit and berry crops.*

2.3. Overview of the current regulatory framework of Ukraine on climate change adaptation in processing

Development of strategic documents. In October 2021, the Cabinet of Ministers of Ukraine approved the Strategy for Environmental Security and Climate Change Adaptation for the period up to 2030 by its Resolution No. 1363-p dated 20.10.2021. The Strategy does not explicitly identify the processing industry as a socio-economic sector that is vulnerable to climate change. In this context, it is recommended to develop a strategic document that addresses aspects of climate change adaptation in the processing industry, and particularly the food industry.

Comparison of Ukrainian and EU standards

Comparison of national regulations on the use and recycling of packaging (Law of Ukraine 'On Waste Management' of 20.06.2022 No. 2320-IX; Order of the Ministry of Economy and European Integration of Ukraine 'On Approval of the Procedure for Collection, Sorting, Transportation, Processing and Disposal of Used Packaging' of 02.10.2001 No. 224; GOST 23285-78 Transport packages for food and glass containers. Technical specifications; GOST 13799-81 Canned fruit, berry, vegetable and mushroom products. Packaging, labelling, transportation and storage) and EU regulations (European Parliament and Council Directive 94/62/EC of 20 December 1994 on packaging and packaging waste; Directive (EU) 2019/904 of the European Parliament and of the Council of 5 June 2019 on the reduction of the impact of certain plastic products on the environment) indicates the need for the following measures: 1) adoption of the Law on the Production, Use and Recycling of Packaging, which should provide for: a) reduction of fossil fuel packaging production; b) a strategy to increase the share of packaging that is recycled; c) measures to reduce packaging volumes; d) introduction of innovative packaging recycling methods; 2) updating the Law of Ukraine 'On Waste Management' dated 20. 06.2022 No. 2320-IX; Order of the Ministry of Economy and European Integration of Ukraine No. 224 of 02.10.2001; GOST 13799-81 and GOST 23285-78.

The list of Ukrainian standards and relevant EU standards for processing fruits, berries and nuts is provided in Annex 3.

Recommendations for adaptation to climate change processing of fruits, berries and nuts

In fruit, berry and nut processing, water and energy supply are of great importance, and they are at risk under climate change. Given these circumstances, it is advisable to take the following measures to increase the production sustainability of enterprises: 1) reducing water and energy use through water and energy efficiency methods; 2) introducing innovative technologies and equipment that save water and energy consumption; 3) transitioning to self-sufficiency in water and energy (artesian wells, wind turbines, photovoltaic panels, local biofuels, etc.) to the maximum extent possible, depending on local capabilities; 4) introducing water treatment and reuse systems.

In the context of climate change, agriculture is undergoing structural changes and is becoming generally unstable. In this context, to ensure continuous production, it is

advisable to diversify the range of agricultural raw materials processed and the range of finished products. A diversified production structure allows for a more flexible response to changing external conditions.

To better consider the conditions and capabilities of processing enterprises to adapt to climate change, it is advisable to develop a specialized strategy for the processing industry based on the Strategy for Environmental Safety and Climate Change Adaptation until 2030.

Following the example of the European Union, a national Code of Conduct should be developed to promote environmental standards among food producers. Among the first signatories of this code in the EU were Coca-Cola, Danone, Metro AG, Mondelez, Nestle, PepsiCo, and Unilever, which also have production facilities in Ukraine. By making voluntary commitments to adapt to climate change, these companies can set an example for other domestic processors, including fruit and berry processors.

The process of harmonization of Ukrainian and EU standards should be extended to nut products.

2.4. Overview of the current regulatory framework of Ukraine on climate change adaptation in the context of export

The existing regulatory framework of Ukraine on climate change adaptation concerning export

In the Strategy for the development of the export of products of agriculture, food and processing industry of Ukraine until 2026, among the main challenges for the further development of the agro-industrial sector of Ukraine in the context of increasing the export of products of agriculture, food and processing industry, adaptation to changes in agro-climatic conditions is identified first. Also, among the challenges - the need to diversify commodity positions of agricultural, food, and processing industry exports (including organic products).

The Strategy does not define other measures for adaptation to climate change. Also in the in the preamble of the Project of the Strategy for the Development of Agriculture and Rural Areas in Ukraine for the period up to 2030[116] it is noted that the State policy in the field of agriculture and rural areas of Ukraine needs a significant reassessment of approaches to its formation, a clear definition of priorities, tasks and effective ways of creating favorable conditions for the development of a competitive, sustainable and diversified agricultural sector that ensures long-term food security, protection of the natural environment, including biodiversity, mitigation of the consequences of climate change. Within the framework of Strategic Goal 2, “Guaranteeing public needs for high-quality, nutritious and safe food products and achieving food security”, Task 2, “Contribute to the provision of food security”, the task of increasing the level of promotion of Ukrainian food to foreign markets is defined. When specifying this task, the Strategy refers to the Strategy for the development of the export of products of agriculture, food and processing industry of Ukraine until 2026.

Provisions of the EU-Ukraine Association Agreement on climate change adaptation and trade in sustainable food

Provisions on climate change adaptation

The objectives of the cooperation of the EU and Ukraine on environmental issues are defined i n Chapter 6 (Environment) of the EU-Ukraine Association Agreement, inter alia, development and implementation of a policy on climate change:

- Implementation of the Kyoto Protocol by Ukraine that involves fulfilling all the eligibility criteria required for the comprehensive utilization of the Kyoto mechanisms.
- Development of an action plan for long-term (i.e., post-2012) mitigation of and adaptation to climate change.
- Development and implementation of long-term measures to reduce emissions of greenhouse gases.

[116] Project of the Strategy for the Development of Agriculture and Rural Areas in Ukraine for the period up to 2030. https://minagro.gov.ua/npa/stratehiia-rozvytku-silskoho-hospodarstva-ta-silskykh-terytorii-v-ukraini-na-period-do-2030-roku

Approximation of Ukrainian legislation in the field of sanitary and phytosanitary measures to EU legislation in accordance with Annexes IV-A, IV-B, IV-C and V

In accordance with Chapter IV “Sanitary and Phytosanitary Measures” of Section IV “Trade and Trade-Related Issues” of the Association Agreement between Ukraine and the EU, Ukraine must implement an equivalent European system of control over the quality and safety of food products (to this end, the Government of Ukraine approved the Comprehensive Strategy for the Implementation of Chapter IV (Strategy of the SPS), which defines the schedule for the systematic normative and legal adaptation of the legislation to the EU legislation (Decree of the CMU of February 24, 2016, No. 228-r[117]).

The main obligations of Ukraine within the framework of the SPS Strategy include:

- reforming the system of state control of the safety of food products, feed and by-products of animal origin in accordance with EU legal acts,
- improving the legislation on providing consumers with information about food products,
- review of the maximum levels of residues of veterinary drugs, pesticides and agrochemicals, as well as ensuring effective monitoring of such residues,
- improving the phytosanitary status in Ukraine and ensuring the protection of plant health,
- establishment of requirements for the production and circulation of the new food products, food additives, items and materials in contact with food products.

Comparison of Ukrainian, EU and Green Deal standards for sustainable fruits, berries, nuts and their processed products, as well as recommendations for the implementation of relevant EU regulations in Ukraine, is presented in Annex 5.

[117] On the approval of the Comprehensive Strategy for the Implementation of Chapter IV (Sanitary and Phytosanitary Measures) of Section IV "Trade and Trade-Related Matters" of the Association Agreement between Ukraine, on the one hand, and the European Union, the European Atomic Energy Community and their member states, on the other hand. Order of the CMU dated February 24, 2016. №228-p https://zakon.rada.gov.ua/laws/show/228-2016-%D1%80#Text

03 GENDER SITUATION IN FRUIT, BERRY, AND NUT PRODUCTION IN UKRAINE

3.1. General outline

The attention to gender[118] dimension is important in any economic activity, as it allows to bring benefits to both men, women, industry, and even social policy of the country in general. What benefits does an employer gain from increasing the proportion of women in the workforce? According to the International Finance Corporation (IFC), a higher share of women in the workforce contributes to increased productivity and innovation. The introduction of new working methods enhances team dynamics and improves decision-making processes. Data from the EU and the US indicates increased sales volumes, market growth, and profitability[119].

In the 2023 Global Gender Equality Ranking, Ukraine ranks 66th out of 149 countries, indicating some progress compared to 2022, when it ranked 81st[120]. The ranking is based on assessments of economic participation and opportunities, educational attainment, access to healthcare, and the expansion of political rights and opportunities.

As of 2023, there were 21.47 million women and 18.23 million men in Ukraine, for a total population of 39.7 million people[121]. The number of men is projected to decrease even further as a result of war .

Regarding higher education, women in Ukraine are more enrolled in universities, and Fig. 3.1 indicates the ratio of women to men as students in Ukraine.

Fig. 3.1. Gender parity among students in Ukraine, %

Source: SSSU (2024) Higher and professional higher education in Ukraine in 2023. https://ukrstat.gov.ua

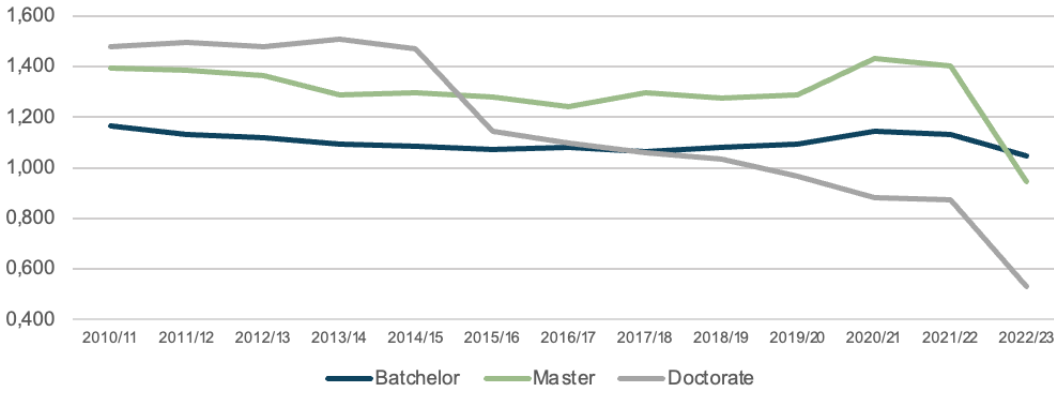


Fig. 3.1 indicates not the declining number of students, but the fact that the number of men enrolled to obtain a Bachelor degree is slowly decreasing; the number of women to obtain a Master's degree tremendously decreased in 2022/2023, which can be explained by the increased number of men willing to obtain Master's degree (enrollment in the universities in some cases allows to postpone enrollment to the army); it is also the case for the growing share of men willing to obtain a Doctorate degree.

According to the SSSU[122], as of 2023, in Agriculture, Forestry, Fisheries, and Veterinary, twice more men (67.11%) were employed than women (32.89%)[123]. We may say that agriculture, together with Engineering, Manufacturing, Construction, as well as Information and Communication Technologies, used to be predominantly "male" occupations, unlike Education, Health and Welfare, or Journalism and Information, which are predominantly "female" occupations.

[118] Authors of the study fully acknowledge the fact that there are more than two genders. Due to the full-scale invasion, the studies or the statistics representing on the LBGTQ group are not available in Ukraine. Therefore, based on the statistics available, we focus on the issues of men, women and veterans (of all genders).

[119] How to Advance Women in the Global Oil & Gas Industry? A Gulf Intelligence Special Report 2015 http://thegulfintelligence.com/mediafiles/cataloguedatasheet/3440e6a1-91c0-4181-b003-18469b21fad1.pdf

[120] The Global Gender Gap Report 2023. World Economic Forum. https://www3.weforum.org/docs/WEF_GGGR_2023.pdf

[121] https://www3.weforum.org/docs/WEF_GGGR_2023.pdf

[122] https://www3.weforum.org/docs/WEF_GGGR_2023.pdf

[123] https://www3.weforum.org/docs/WEF_GGGR_2023.pdf

Similarly to almost any other industry, the number of people employed in Ukraine's Agriculture, Forestry, and Fishing is declining (Fig. 3.2).

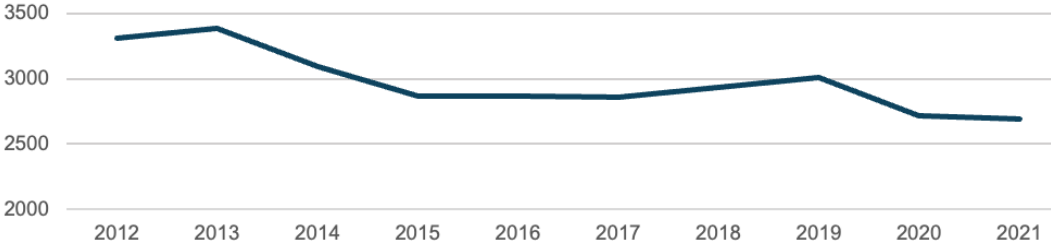


Fig. 3.2.
The number of employed in Agriculture, Forestry and Fishing of Ukraine in 2012-2021, thousands

Source:
State Statistic Service of Ukraine
Employed population by type of economic activity in 2012-2021
https://ukrstat.gov.ua

Women in Ukraine carry the unproportionally large load (compared to men) of unpaid caring labor, as confirmed by the studies (Fig. 3.3).

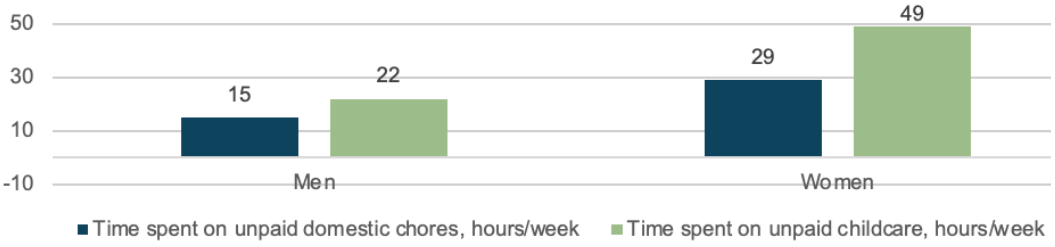


Fig. 3.3.
Time spent on unpaid domestic chores and unpaid childcare in Ukraine, hours/week

Source:
UNFPA (2018) Masculinity today: men's attitudes to gender stereotypes and violence against women. United Nations Population Fund. https://ukraine.unfpa.org/sites/default/files/pub-pdf/Masculinity%20Today%20Men%27s_Report.pdf

Before the full-scale war, the responsibility of caring for minors and elderly family members fell heavily on individuals. With the onset of the war, this responsibility expanded to include the care of disabled men. Ukraine's social system lacks facilities such as nurseries or centers capable of providing care for children, the elderly, or disabled individuals for up to 8 hours a day. This absence limits opportunities for women to pursue professional growth or engage in work, including in the agricultural business sector.

Another factor follows from the information stated above. Women in Ukraine have lower GNIP per capita compared to men due to serious gender pay gap: in Ukraine women make 23% less than men[124], also because many women are busy with unpaid caring labor (Fig. 3.4).

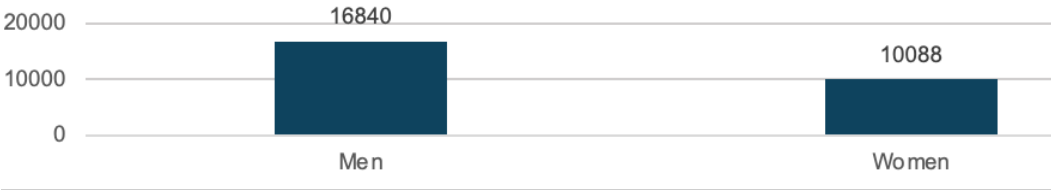


Fig. 3.4.
Estimates Gross National Income per capita (PPP) in Ukraine in 2019, USD

Source:
https://www.undp.org/ukraine/gender-profile-ukraine

Due to the war and forced migration of many people abroad, Ukraine faces a sharp deficit in labor force. The estimates of the deficit vary up to 5 million people, and it will increase as the war progresses. The 2024 survey revealed that 53% of respondents acknowledge the labor deficit as a threat. To overcome the deficit, the surveyed suggested measures like re-training of the existing personnel, returning of Ukrainians from abroad, but only 15% approved the teaching of women to occupy traditionally "male" professions[125].

During the war, a significant number of men, and to some extent women, will face fatalities or sustain injuries that render them unable to work. This fact imposes additional difficulties on women, as women will need to engage more actively in the labor force. To make it happen, numerous measures need to be undertaken, which must be a significant part of the social policy of the country.

Whereas the distortions in the number of enrolled men to obtain the higher education degree are caused by war and are temporary of their nature, it is possible to say that the role of higher education is over-estimated in Ukraine. The assessment of the quality of higher education in Ukraine lies beyond the scope of the study, yet it causes the discussion on whether the degree is needed for almost everyone, whether people use the obtained diploma for further employment, whether the money spent to obtain the degree was spent efficiently, etc.

[124] JurFem (2019) Gender aspects of remuneration. https://jurfem.com.ua/genderni-aspekty-oplaty-praci/#:~:text=Відповідно%20до%20даних%20Державної%20служби,році%20–%2021%2C%202%25.

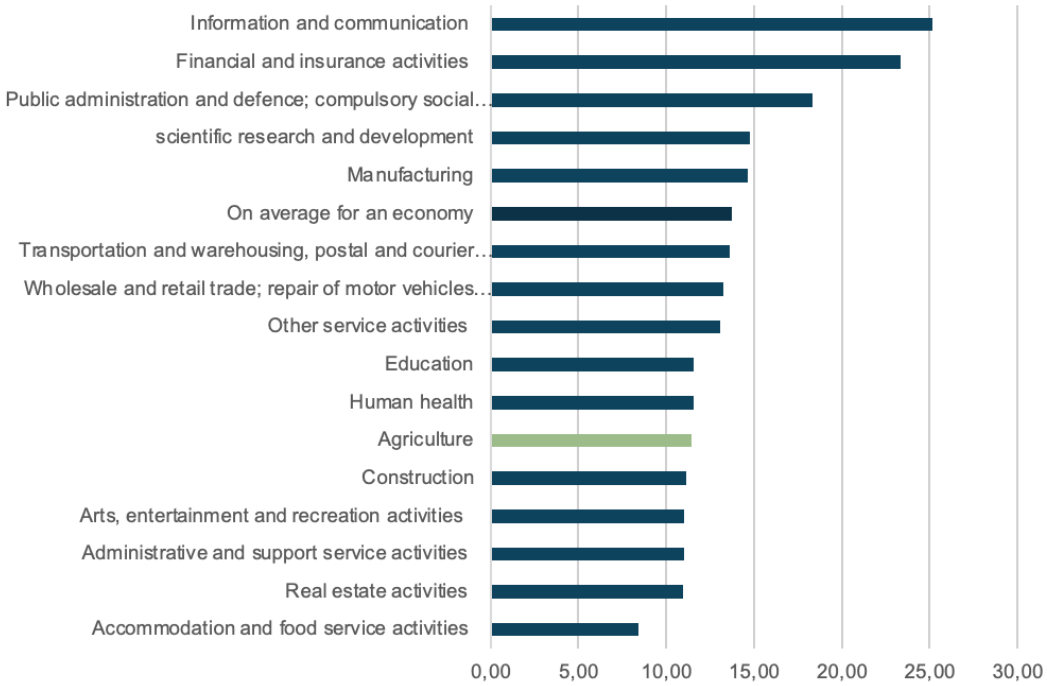
[125] Razumkov (2024) Labor Resources for Post-War Reconstruction of Ukraine (June 2024). Razumkov Center . https://razumkov.org.ua/napriamky/sotsiologichni-doslidzhennia/trudovi-resursy-dlia-povoiennogo-vidnovlennia-ukrainy-cherven-2024r

3.2. Gender disproportions in agriculture of Ukraine

Agriculture is the industry that pays well below the average on the economy (Fig. 3.5), and this trend is observed within the last couple decades, as confirmed by SSSU and 2030 National Economic Strategy of Ukraine.

Fig. 3.5. Average wage of regular employees by type of economic activity in 2021, UAH thousand

Source: SSSU (2024)



In Ukraine, the average distribution of company heads is approximately 71% men and 29% women. However, in the agricultural sector, the ratios differ. Activities such as growing pome and stone fruits, cultivating other tree and bush fruits and nuts, providing support for crop production, and handling post-harvest crop processes show an 80% male to 20% female ratio as of January 2024[126].

Considering the distribution of natural entities-entrepreneurs by gender, one may observe a higher involvement of women as heads of such entities in Ukraine on average. The reasons for it lie most likely beyond the gender policy:

- Establishing a natural entity-entrepreneur involves fewer permitting documents and simpler procedures compared to creating a legal entity.
- Taxes for natural entity-entrepreneurs are significantly lower than those for legal entities.
- There is no requirement for share capital.
- Legal repercussions are minimal if business operations fail.

However, the involvement of women as heads of natural entities-entrepreneurs in agriculture, in particular in producing nuts and berries remains even lower than the distribution of women-heads of legal entities . For instance, in general in Ukraine it is 52.5% men/47.5% women; growing of other tree and bush fruits and nuts – 26.9%/73.1%; growing of pome fruits and stone fruits – 79.4%/20.6%; plant propagation – 58.4%/41.6%; support activities for crop production – 81.8%/18.2%; post-harvest crop activities - 82.4%/17.6%[127].

[126] SSSU (2024) Number of registered individual entrepreneurs by type of economic activity, broken down by gender of the head https://ukrstat.gov.ua/edrpoy/ukr/EDRPU_2024/fop_kved/arh_fop_kved_24.htm

[127] SSSU (2024) The number of registered individual entrepreneurs by type of economic activity, broken down by the gender of the head as of January 01, 2024 https://ukrstat.gov.ua/edrpoy/ukr/EDRPU_2024/fop_kved/arh_fop_kved_24.htm

3.3. Gender disproportion in apples, berries in Ukraine

Below, we analyzed the information about the gender distribution in the management of companies that produce, process, and export apples (101 companies) and berries of interest (63 companies) in Ukraine. We used open sources of information such as internet catalogues of companies, specific data sources on companies (DataBot, YouContol), and the 2023 Ukrainian Berry Industry Catalogue. The latter presents information about the companies producing fresh berries, semi-processed berries, and processed berries. The gender distribution of the companies' management is presented in Fig. 3.6.

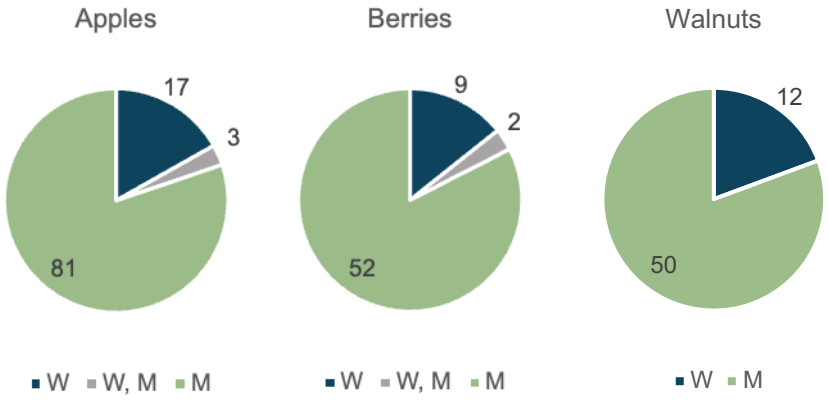


Fig. 3.6. Gender distribution in companies' management in apples, berries, and walnuts subsectors in Ukraine

Source: the 2023 The Ukrainian Berry Industry Catalogue; YouControl.com.ua, OpenDatabot.ua

The conducted analysis of apples, berries, and walnuts production and processing revealed that the vast majority of companies' heads are men. Women are usually employed as accountants or financial directors with the right of signature (depending on the organizational type of the company).

3.4. Gender-related legislation in the EU and Ukraine

In this section, the focus is on gender legislation in the EU and Ukraine. The EU legislation consists of the pan-European legislation, presented in Directives and other types of legislation, and country-specific legislation. Later, we consider gender-related legislation in Ukraine and draw conclusions and policy recommendations for Ukraine based on the results of the analysis.

- The following key aspects of gender (in)equality can be distinguished, which are addressed in EU legislation:
- Equal wages for equal work;
- Equal work-life balance and work conditions;
- Gender-based violence;
- Non-discrimination[128].

a) The European gender-related legislation

Equal wages for equal work

In many countries globally, including Europe, in the middle of the XX century, gender disparities in wages were prevalent. The ILO Equal Remuneration Convention (No. 100)[129] (1951) stated that "Each Member shall, by means appropriate to the methods in operation for determining rates of remuneration, promote and, in so far as is consistent with such methods, ensure the application to all workers of the principle of equal remuneration for men and women workers for work of equal value", and Belgium and France adopted this provision in 1952 and 1953 respectively.

In the EU, the founding Treaty of Rome (1957) in Article 119, Title VIII claimed that "*Each Member State shall during the first stage ensure and subsequently maintain the application of the principle that men and women should receive equal pay for equal work*". This provision was driven by solely economic considerations and economic pragmatism (to ensure competitiveness or goods where the share of women labor was high (highly

[128] https://www.europarl.europa.eu/factsheets/en/sheet/59/equality-between-men-and-women

[129] https://normlex.ilo.org/dyn/normlex/en/f?p=NORMLEXPUB:12100:0::NO::P12100_INSTRUMENT_ID:312245

feminized industries[130]), such as textile, within the new Union)[131]. Since the founding parties had different sets of rights for men and women, and in some cases different pay, this fact could distort the prices of goods and impede free trade of goods between countries. Yet, equal wages for men and women didn't happen immediately with the adoption of the Treaty of Rome because it could bring tremendous economic losses due to the necessity to increase women's wages, or alternatively, to decrease men's wages, would be unacceptable. Nonetheless, Article 119 has become a foundational principle of construction of equality and non-discrimination in the further European legislation.

Later, the so-called Equal Pay Directive (1975)[132] enhanced the principle of equal payment between men and women for equal work. The Equal Treatment Directive (1976)[133] required that member states would ensure equal access to employment, training, promotions, and working conditions.

The **Pregnant Workers Directive (1992)[134] acknowledged the fact that pregnant workers or those who gave birth recently or are breastfeeding face specific risks at their workplace.**

The Treaty of Amsterdam (1997)[135], adopted to transfer certain rights from the national governments to the central government, inter alia, mainstreamed the gender policy of the EU. In Article 13, the EU was empowered to take actions against discrimination based on gender, race, ethnicity, religion, disability, age, and sexual orientation. Yet, Article 13 was not easy to implement for a number of reasons, such as the fact that the European Commission has only the ability but not the obligation to act. Many countries admitted that their own legislation was not always effective or even poorly applied. Member states were expecting the European Commission to finance the measures to implement Article 13 in the countries[136].

The **Gender Equality Directive (2006)**[137] is a foundational piece of European legislation on gender equality. It brought together earlier directives and broadened the scope of protections to address not only equal pay and treatment but also gender-based discrimination in areas like occupational pensions, promotion, and sexual harassment. This directive also strengthened the role of gender equality bodies (which member states had to create), making them central to monitoring and enforcing gender equality laws across EU member states. These bodies play a vital role in ensuring compliance with EU legislation and providing support to victims of discrimination.

Equal work-life balance and work conditions

The Parental Leave Directive[138] (2010) guaranteed both men and women the right to take time off work (4 months) to care for their children, thereby altering traditional gender roles in caregiving. It was repealed by the Work-Life Balance Directive[139] (2019) that is a key piece of legislation designed to improve gender equality by encouraging the equal sharing of family responsibilities between men and women, aimed, inter alia, at the creation of a

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130 ILO: Social aspects of European economic co-operation: Report by a group of experts (Geneva, 1956). https://researchrepository.ilo.org/esploro/outputs/journalArticle/Social-aspects-of-European-economic-co-operation/995319228302676

131 https://www.ofce.sciences-po.fr/blog/the-treaty-of-rome-and-equality-2/

132 Council Directive 75/117/EEC of 10 February 1975 on the approximation of the laws of the Member States relating to the application of the principle of equal pay for men and women https://eur-lex.europa.eu/legal-content/en/ALL/?uri=CELEX%3A31975L0117 (no longer in force)

133 Council Directive 76/207/EEC of 9 February 1976 on the implementation of the principle of equal treatment for men and women as regards access to employment, vocational training and promotion, and working conditions https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A31976L0207 (no longer in force)

134 Council Directive 92/85/EEC of 19 October 1992 on the introduction of measures to encourage improvements in the safety and health at work of pregnant workers and workers who have recently given birth or are breastfeeding (tenth individual Directive within the meaning of Article 16 (1) of Directive 89/391/EEC) https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A31992L0085 (in force)

135 https://www.europarl.europa.eu/about-parliament/en/in-the-past/the-parliament-and-the-treaties/treaty-of-amsterdam

136 Chopin, E. (1999) Article 13: A New Challenge for European Institutions https://www.migpolgroup.com/_old/wp-content/uploads/2016/10/113.Article13-ANewChallengeforEuropeanInstitutions_EN_01.99.pdf

137 Directive 2006/54/EC of the European Parliament and of the Council of 5 July 2006 on the implementation of the principle of equal opportunities and equal treatment of men and women in matters of employment and occupation (recast) https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A32006L0054 (in force)

138 Council Directive 2010/18/EU of 8 March 2010 implementing the revised Framework Agreement on parental leave concluded by BUSINESSEUROPE, UEAPME, CEEP and ETUC and repealing Directive 96/34/EC https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A32010L0018 (No longer in force)

139 Directive (EU) 2019/1158 of the European Parliament and of the Council of 20 June 2019 on work-life balance for parents and carers and repealing Council Directive 2010/18/EU https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A32019L1158 (in force)

bond between fathers and children and at the reduction of burden on women to balance work and family responsibilities. The directive introduces several important measures:

- Paid Parental Leave: e ach parent is entitled to four months of leave, with at least two months designated as non-transferable, ensuring that both parents have the opportunity to take time off.
- Carers' Leave: provides five days of annual leave for workers to care for seriously ill or dependent relatives.
- Flexible Working Arrangements: g rants the right to request flexible hours and remote work, supporting work-life balance and helping to reduce gender disparities in caregiving.

This directive is part of the EU's larger efforts to close the gender employment gap and to tackle challenges from demographic shifts, including aging populations and declining birth rates.

The Directive on gender balance among directors of listed companies[140] (2022) acknowledges that the EU has a large pool of highly qualified women, which is constantly growing, confirmed by the fact that 60 % of university graduates are female; yet the share of women on high roles in corporate sector is low. The Directive sets binding targets for gender representation on the boards of publicly listed companies:

- By 2026, at least **40% of non-executive directors** on these boards should be of the underrepresented gender.
- Alternatively, member states can choose a target of 33% for all directors, both executive and non-executive.

This legislation represents a step in addressing the underrepresentation of women in leadership roles and corporate governance across Europe. It is expected to have a considerable impact on the gender composition of decision-making bodies in the private sector. Some countries have established mandatory quotas for a share of women in political parties (France, Germany, Belgium).

Gender-based violence

The EU has undertaken efforts to combat Gender-Based Violence. In particular, the EU (but not all member states[141]) ratified the **Istanbul Convention[142]** (2011), a Convention against women and domestic violence. It is not an EU directive, but it is a legally binding instrument in the EU aimed at preventing violence, protecting victims, and prosecuting perpetrators.

The Victims' Rights Directive[143] (2012) provides protections for victims of crime, including victims of gender-based violence, and the EU has adopted various measures to combat human trafficking, female genital mutilation, and domestic violence.

The European Commission has outlined gender-based violence as a priority in its **Gender Equality Strategy 2020-2025[144]**, advocating for stronger laws and better enforcement mechanisms at the national level. Its priorities are:

- Ending gender-based violence: the EU aims to expand its legal framework to better protect victims and ensure justice for perpetrators.
- Closing the gender pay and pension gaps: efforts will focus on transparency in wage structures, equal pay audits, and pension reforms that address the disparities women face in retirement.

[140] Directive (EU) 2022/2381 of the European Parliament and of the Council of 23 November 2022 on improving the gender balance among directors of listed companies and related measures https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32022L2381 (in force)

[141] In the EU, Bulgaria, Czech Republic, Hungary, Lithuania and Slovakia haven't ratified the Istanbul convention

[142] Council of Europe Convention on preventing and combating violence against women and domestic violence https://www.coe.int/en/web/conventions/full-list?module=treaty-detail&treatynum=210

[143] Directive 2012/29/EU of the European Parliament and of the Council of 25 October 2012 establishing minimum standards on the rights, support and protection of victims of crime, and replacing Council Framework Decision 2001/220/JHA https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1421925131614&uri=CELEX:32012L0029 (in force)

[144] https://ec.europa.eu/newsroom/just/items/682425/en

- Achieving gender balance in decision-making: beyond corporate boards, the EU is likely to pursue policies that encourage gender parity in politics and other areas of public life.
- Promoting gender equality globally: the EU is expected to strengthen its external policies on gender equality, supporting women's rights and empowerment in its international partnerships and development programmes.

Non-discrimination

The EU has also strengthened its legal framework to address multiple forms of discrimination that intersect with gender. The **Race Equality Directive**[145] **(2000)** and **Employment Equality Directive**[146] **(2000)** prohibit discrimination on grounds of race, religion, disability, age, and sexual orientation in employment, education, and other areas in recruitment, working conditions, and promotion. These laws recognize that gender discrimination often intersects with other forms of discrimination, leading to compounded disadvantages for certain groups, such as women of color, LGBTQ+ individuals, and disabled women.

The EU's focus on intersectionality is reflected in its broader anti-discrimination strategy, which aims to create an inclusive society where all forms of discrimination are eradicated. This approach is essential for addressing the diverse experiences of women and other marginalized groups within the EU.

Despite the EU's comprehensive legal framework that started to develop in 1950 s, challenges remain in the implementation and enforcement of gender equality laws across member states. Different cultural norms, economic conditions, and legal systems contribute to varying levels of compliance. In the EU, the gender pay gap still exists, with disparities between member states being 12.7% in 2022. It means that women would earn 12.7% less per hour than men. 69.3 % of women across the EU were employed compared to 80% of men[147]. Women remain underrepresented in leadership roles. Gender-based violence remains widespread, and its rise was especially remarkable during the COVID-19 pandemic, when in many countries, people were locked in their homes. The presence of these phenomena indicates the necessity to strengthen the enforcement mechanisms and to fund the gender equality bodies. In countries with a strong religious Catholic background (Poland), women have fewer reproductive rights compared to women in other EU member states, as abortions are prohibited (with few exemptions). Additionally, women may be employed in spheres that are traditionally paid less (healthcare, agriculture, etc), which may further aggravate their lower earnings. Numerous factors influencing gender pay disparities extend beyond legislative or regulatory frameworks. These include the high costs of childcare and institutional medical care, which often force women to opt for part-time jobs or withdraw from the workforce entirely.

b) Gender-related legislation in Ukraine

The framework of gender-related legislation in Ukraine consists of the Constitution of Ukraine, the Labor Code of Ukraine, the Law of Ukraine "On Employment of the Population", Law of Ukraine "On Remuneration of Labor", Law of Ukraine "On Labor Protection", Law of Ukraine "On Leave", Law of Ukraine "On the Organization of Labor Relations under Martial Law". It is worth noting that similar aspects (e.g., labor protection) are listed in many documents, repeating each other; the division into topics (such as non-discrimination or leaves) is very conditional.

Work conditions

Labor Code of Ukraine[148] *(1971 with amendments)* prohibits to refusing employment to women or to reducing their wages due to pregnancy or having children under the age of three, and for single mothers, due to having a child under the age of fourteen or a child with

[145] Council Directive 2000/43/EC of 29 June 2000 implementing the principle of equal treatment between persons irrespective of racial or ethnic origin https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A32000L0043 (in force)

[146] Council Directive 2000/78/EC of 27 November 2000 establishing a general framework for equal treatment in employment and occupation https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A32000L0078 (in force)

[147] https://commission.europa.eu/strategy-and-policy/policies/justice-and-fundamental-rights/gender-equality/equal-pay/gender-pay-gap-situation-eu_en

[148] https://zakon.rada.gov.ua/laws/show/322-08#Text

disabilities. Enterprises and organizations with extensive employment of female workers must provide nurseries, kindergartens, breastfeeding rooms, as well as personal hygiene rooms for women (this provision is rarely followed).

Pregnant women and mothers of children under three years old are exempt from night shifts, overtime, weekend work, and work-related travel. Women with children aged 3 to 14, or those with children with disabilities, cannot be compelled to work overtime or travel for work without their consent. Additionally, individuals under eighteen and other legally specified worker categories are barred from night shifts.

At the request of a pregnant woman, a woman with a child under the age of fourteen or a child with disabilities, including a child under her guardianship or in her care due to a sick family member (according to medical conclusions), the employer or their authorized representative must establish a part-time work schedule or a shorter workweek for her.

The employer must provide pregnant women and women with children under the age of fourteen or children with disabilities with vouchers to sanatoriums and rest homes free of charge or under preferential conditions, as well as provide them with financial assistance when necessary (this provision is rarely followed).

A reduced working time may be established at the expense of the employer's funds at enterprises and organizations for women with children under the age of fourteen or a child with disabilities, as well as for single mothers and fathers raising a child (including cases of the mother's long-term stay in a medical institution) and women caring for a sick family member.

Based on a medical conclusion, women are entitled to paid leave for pregnancy and childbirth for a duration of 70 calendar days before childbirth and 56 calendar days after childbirth (70 calendar days in case of multiple births or complications during childbirth), starting from the day of delivery. The total duration of the leave for pregnancy and childbirth is 126 calendar days (140 calendar days in case of multiple births or complications during childbirth). It is granted to women in full, regardless of the number of days taken before childbirth.

At the woman's request and in the absence of medical contraindications, part of the leave of 70 calendar days provided before childbirth may be transferred and used by the woman partially or fully after childbirth, starting from the day of delivery. In this case, the total duration of the leave cannot exceed 126 calendar days (140 calendar days in case of multiple births or complications during childbirth).

At the request of the woman, she is granted leave to care for a child until the child reaches three years of age with payment for this period in accordance with the legislation (a s of 2024, the first payment after the childbirth is EUR 229, all next payments are EUR 19/ month[149]). Alternatively, this leave may also be used by the child's father. Companies and organizations may provide women with partially paid leave and unpaid leave for childcare of a longer duration at their own expense.

Leaving for childcare until the child reaches the age of three is not granted if the child is under state care, except for foster children in foster families and children in family-type orphanages. If the child requires home care, the woman is mandatorily granted unpaid leave for a duration determined by a medical conclusion, but not beyond the child's sixth birthday. The leaves for childcare can also be used in full or in parts by the child's father, grandmother, grandfather, or other relatives who care for the child. At the request of the woman or the other carer , during their leave for childcare, they may work part-time or from home.

Women with children under the age of one and a half years are granted breaks for breastfeeding in addition to their regular breaks. Temporary transfer of pregnant women and women with children under six years of age or children with disabilities to other work not specified in the employment contract is possible only with their consent.

Law of Ukraine "On Labor Protection" (1992 with amendments) states that the employment of women is prohibited in heavy work; in jobs with harmful or dangerous working conditions; in underground work, except for certain underground jobs (non-physical jobs or jobs related to sanitary and domestic services); at night, except in sectors of the economy where it is necessary and permitted as a temporary measure; engaging women in lifting and moving items whose weight exceeds the established limits according to the list of heavy work and work with harmful and dangerous working conditions, as well as the maximum lifting

[149] Sufficient for approximately 60 diapers.

and moving limits for heavy items, which are approved by the specially authorized central executive authority in the field of health protection. The maximum allowable lifting and moving limits for women are:

- Lifting and moving loads while alternating with other work - 10 kg;
- Lifting and moving loads continuously throughout the shift - 7 kg;

Total weight of the load during movement each hour of the work shift from the working surface - 350 kg; from the floor - 175 kg.

The list of heavy jobs and jobs with harmful and dangerous working conditions where the employment of women is prohibited, as well as the maximum lifting and moving limits for heavy items by women, are approved by the Ministry of Health of Ukraine, in agreement with the central executive authority responsible for formulating state policy in the field of labor protection.

Law of Ukraine "On Leave" (1996 with amendments)[150] states that people are entitled to vacations and leaves. Annual leave is provided at the employee's request at a convenient time for them for persons under the age of eighteen; women before or after leave due to pregnancy and childbirth; women with two or more children under the age of fifteen or a child with disabilities; single mothers (or fathers) raising a child without a parent; guardians, caregivers, or other single individuals who care for one or more children under the age of fifteen in the absence of parents; wives (or husbands) of military personnel.

A woman who works and has two or more children under the age of fifteen, a child with disabilities, or who has adopted a child, or the mother of a child with a disability, a single mother, or the father of a child or a person with a disability who is raising them without the mother (including in cases where the mother is in a medical institution for a long time), as well as a person who has taken a child or a person with a disability under guardianship, or one of the foster parents, is granted an additional annual paid leave of ten calendar days without counting public holidays and non-working days. If there are several grounds for granting this leave, its total duration cannot exceed seventeen calendar days.

Non-discrimination

Family Code of Ukraine[151] (2002 with amendments) states that a woman and a man have equal rights and responsibilities in family relations, marriage, and family.

Law of Ukraine "On Ensuring Equal Rights and Opportunities for Women and Men"[152] (2005 with amendments) enshrines the principle of equal rights and opportunities for women and men and obligates state bodies to counter discrimination based on gender. It protects from sexual harassment in the workplace and prevents gender-based violence in all areas of life.

The National Strategy for Overcoming the Gender Pay Gap for the period up to 2030[153] (2023) aims to reduce the gender pay gap by 5% points by 2030 compared to 2021.

Gender-based violence

In Ukraine, legislation on gender-based violence is actively evolving, especially in recent years, to align with international standards, particularly considering the requirements of the Istanbul Convention, which Ukraine signed in 2011 and ratified in 2022[154] (to meet the requirements of the Association Agreement between the EU and Ukraine). The main legislative acts regulating issues of gender-based violence are listed below.

In the Criminal Code of Ukraine[155] (2001 with amendments), amendments were introduced to criminalize domestic violence and other types of gender-based violence. Domestic violence, which is the intentional and systematic infliction of physical, psychological, or

[150] https://zakon.rada.gov.ua/laws/show/504/96-вр#Text

[151] https://zakon.rada.gov.ua/laws/show/2947-14#Text

[152] https://zakon.rada.gov.ua/laws/show/2866-15#Text

[153] Order of Cabinet of Ministers of Ukraine No. 815-r dated September 15, 2023, "On the approval of the National Strategy for Overcoming the Gender Pay Gap for the period up to 2030 and the adoption of the operational action plan for its implementation for 2023-2025" https://zakon.rada.gov.ua/laws/show/815-2023-р#n14

[154] https://ips.ligazakon.net/document/t222319?utm_source=jurliga.ligazakon.ua&utm_medium=news&utm_content=jl03

[155] https://zakon.rada.gov.ua/laws/show/2341-14#Text

economic abuse against a spouse or former spouse, or another person with whom the offender is or was in a family or close relationship, resulting in physical or psychological suffering, health disorders, loss of ability to work, emotional dependency, or a decline in the quality of life of the victim, is punishable by community service for a period of 150-240 hours, or probation supervision for up to five years, or restriction of freedom for the same period, or imprisonment for up to two years.

Law of Ukraine "On Prevention and Combating Domestic Violence"[156] (2017 with amendments) defines "domestic violence" to include physical, psychological, sexual, and economic violence. The law provides a comprehensive approach to preventing violence, including preventive measures, assistance for victims, and accountability for violence. Important tools include the Temporary Restraining Order and the Protective Order, which protect victims by restricting contact with the aggressor.

Code of Ukraine on Administrative Offenses[157] (1984 with amendments), inter alia, regulates administrative liability for domestic violence, providing for fines, corrective labor, and administrative arrest.

Gender Policy Enforcement

In 2017 in Ukraine, a position of the Government Commissioner for Gender Policy[158] was established to enforce the gender-related legislation. In 2017, the government of Ukraine declared gender equality as one of its priorities for the first time. The Government Commissioner (GC) is an official responsible for organizing the implementation of the Cabinet of Ministers of Ukraine's powers in ensuring equal rights and opportunities for women and men in all areas of societal life. The nomination for the GC position is submitted for consideration to the Prime Minister of Ukraine by the Vice Prime Minister for European and Euro-Atlantic Integration of Ukraine.

The main tasks of the GC include, among others, promoting the implementation of state policy aimed at achieving equal rights and opportunities for women and men in all areas of societal life; monitoring the Cabinet of Ministers of Ukraine's consideration of the principle of gender equality when adopting normative legal acts; collaborating and interacting with civil society institutions on issues related to ensuring equal rights and opportunities for women and men in all areas of societal life. The GC facilitates the coordination of actions to implement recommendations from international human rights institutions and observations from international monitoring missions and organizations by executive authorities and local self-government bodies; submits proposals to the Cabinet of Ministers of Ukraine regarding the inclusion of issues related to ensuring equal rights and opportunities for women and men in all areas of societal life in programme documents; and informs the public about ensuring equal rights and opportunities for women and men, as well as decisions made by the Cabinet of Ministers of Ukraine on these matters.

To ensure compliance with the laws, there are orders and directives of the National Police. There is a registry system for domestic violence cases in place, and a network of support services, including shelters, hotlines, and counseling centers, has been established. The ratification of the Istanbul Convention requires additional training for law enforcement officers, improving legal procedures, and supporting specialized institutions for victims of violence.

c) Conclusions and Policy Recommendations for Ukraine

To summarize, it may be stated that the EU gender-related legislation is well-developed, aims to tackle many weak points, and goes far ahead of mere statements about gender equality. In particular, it tackles many areas such as employment, work-life balance for caregivers, ensuring that women can participate not only in family life but also in the labor market, domestic violence, protection of victims, discrimination, and many others. With the necessity to strengthen the enforcement mechanisms, the EU will need to expand the legislation to include gender minorities in the bill to meet their needs from the perspective of employment, medical and psychological support, access to services, etc.

It may be concluded that gender-related labor legislation in Ukraine is relatively lenient towards Ukrainian women and does not foresee discrimination based on gender. On

[156] https://zakon.rada.gov.ua/laws/show/2229-19#Text

[157] https://zakon.rada.gov.ua/laws/show/80731-10#Text

[158] https://zakon.rada.gov.ua/laws/show/390-2017-п#Text

the other hand, Ukrainian legislation does not stimulate an increase in the number of women in specific fields, especially in leadership positions. In contrast, some countries have officially established quotas for mandatory representation of women in leadership roles. Legislative shortcomings that would encourage men to participate more in house chores and to become carers stem from outdated cultural norms, beliefs, and conservative social values. Thus, the discourse about work-life balance and equal distribution of duties (so that women would have time for work) is still weak. The only exception is same-sex couples, where chores are normally distributed more equally[159]. Still, it results from internal arrangements within a couple and lies beyond the legislation. Legislation in Ukraine considers a woman a primary caregiver, which is the case for children. Unofficially, it is also the case for older people and now for the veterans, the majority of whom are men.

Legislative changes[160] are to be enacted to engage women more in the labor market in general and in agriculture in particular. Considering Ukraine's EU accession, the most rational way is to fully take the EU's institutional franchise and implement the respective directives, even if they are not yet in the social policy acquis. As a result of these changes, the perception of a woman as a single caregiver has to be changed, enforced by the legislation, to enable women to take part in the labor market.

Other measures may include, but are not limited to, the following:

- Women need time and the possibility to work in paid jobs. It requires the creation of nurseries, daycares, and daycare centers for children, older persons, and disabled family members.
- Higher flexibility in working conditions and hours (flexible schedules, remote work, the possibility to work part-time).
- Mandatory implementation of (high) quotas for women's employment (at the level of government resolutions) and corresponding management directives within companies.
- Additional incentives such as health insurance for employees and their family members. In Ukraine, relatively few employers offer this option, primarily from Western companies.
- Studies and statistical observations are needed to track impact of climate change on men and women in agriculture .
- Special economic programmes for starting new businesses and low-interest loans would significantly benefit women. This requires closer cooperation between the Ministry of Economy, the Ministry of Agrarian Policy, the Ministry of Social Policy, and the Ministry of Veteran Affairs.

159 Beban, A., & Roberts, G. (2023). Fair but not Equal: Negotiating the Division of Unpaid Labour in Same-Sex Couples in Aotearoa New Zealand and Australia. *LGBTQ+ Family: An Interdisciplinary Journal*, *20*(1), 74–91. https://doi.org/10.1080/27703371.2023.2285276

160 Such legislative changes include but are not limited to, implementing the Work-Life Balance Directive (2019) and the Directive on gender balance among directors of listed companies (2022)

ANNEXES

04

Annex 1.

The targets set out in the 2020 Farm to Fork Strategy (F2F) and the EU Biodiversity Strategy 2030 are guidelines for Ukraine

The goals set out in the Farm to Fork Strategy 2020 and the EU Biodiversity Strategy 2030 are benchmarks for Ukraine. A comparison of the state of play in relation to the goals set by these strategies at the EU level and in Ukraine is presented in table 5.1.

Table. 15.1. Indicators of the state of play in relation to the targets set by European strategies for agriculture at the EU level[161] and in Ukraine

Source: compiled from the above references.

Objective and relevant act	In EU	In Ukraine
At least 25% of the EU's agricultural land must be under organic farming. Farm to Fork (F2F) strategies	Between 2012 and 2020, the area under organic farming increased by 55.6% to 9.1% of the EU's agricultural land. More progress will be needed to reach the 2030 target.	In 2021, the area of agricultural land under organic production was 1%, and in 2022, 0.6% of the area of agricultural land[162].
The use of chemical pesticides and hazardous pesticides should be reduced by 50%. F2F	The use of chemical pesticides (and the risks associated with them) decreased by 14% from 2015-2017 to 2020, while the use of more dangerous pesticides decreased by 26%.	The application of pesticides (in active substance) per 1 ha of agricultural land in 2021 increased by 6.9% compared to 2018 and decreased by 22.9% in 2022[163].
Reduce nutrient losses by at least 50% without reducing soil fertility. F2F	The gross balance of nitrogen was 46 kg and phosphorus was 1 kg per 1 ha of agricultural area (the EU average for 2012-2014). The share of groundwater with a nitrate concentration above 50 mg/l was 14.1% in 2016-2019, up from 13.2% in 2012-2015.	The balance of nutrients in soils was negative in 2007-2017 and amounted to: nitrogen 17 kg/ha, phosphorus 13 (2017)[164]. Data on the proportion of groundwater with nitrate concentrations above 50 mg/ will be determined*.
At least 10% of the agricultural area is covered by special landscapes with high biodiversity. Biodiversity Strategy 2030.	Support is provided under the EU's Common Agricultural Policy for approximately 2.86 million hectares to preserve landscape features, including bird habitats that support the life cycle of pollinators.	It is regulated to reduce agricultural development by 5%, ploughing by 10% by withdrawing arable land from intensive cultivation, and to take measures to restore protective forest plantations[165].

** Ukraine, in accordance with the Association Agreement with the EU, has committed to implement Directive 91/676/EEC of 12 December 1991 on the protection of waters against pollution caused by nitrates from agricultural sources into national law. The Ministry of Ecology adopted the Methodology for Determining Areas Vulnerable to (Accumulation of) Nitrates (Order No. 244 of 15.04.2021), and the Ministry of Agrarian Policy approved the Rules for Ensuring Soil Fertility and the Use of Certain Agrochemicals (Order No. 382 of 24.11.2021).*

Enhancing environmental restructuring in Ukraine is advised to develop a sustainable agri-food system aligned with European standards. This process should prioritize decarbonization and climate neutrality, supporting the achievement of Green Deal objectives and embracing the “build back better” principle.

[161] Accompanying the document. Report from the Commission. EU Voluntary Review on progress in the implementation of the 2030 Agenda for Sustainable Development. SWD/2023/700 final. https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52023SC0700&qid=1696529591065

[162] Indicator 2.3.3. Share of agricultural land under organic production in the total area, %. https://sdg.ukrstat.gov.ua/uk/2-3-3/

[163] Agriculture. Application of mineral and organic fertilizers, pesticides (1990-2022). https://www.ukrstat.gov.ua/operativ/menu/menu_u/cg.htm

[164] The state of soil fertility in Ukraine. Institute of Soil Protection of Ukraine, 27 September 2018. https://uabio.org/wp-content/uploads/2018/10/2-yuri-kryvda-workshop-agro-residues-27092018-small.pdf

[165] Order of the Cabinet of Ministers of Ukraine of 19 January 2022 No. 70 "On Approval of the Concept of the National Target Programme for Land Use and Protection". https://zakon.rada.gov.ua/laws/show/70-2022-%D1%80#Text.

Annex 2.

Regulatory and legal documents of Ukraine on soil management to ensure climate adaptation of crop production, 2019-2024

- Order of the Cabinet of Ministers of Ukraine of 2022 No. 70 “On Approval of the Concept of the National Target Programme for Land Use and Protection” - to reduce agricultural development by 5%, ploughed land by 10%; optimize the structure of the agricultural landscape; promote a neutral level of land degradation; increase the productivity of agricultural land by 40-50% through the rational use of organic and mineral fertilizers; take measures to restore protective forest plantations[166]. As for the optimization of the agricultural landscape, it is worth recalling that the Law of Ukraine “On the Basic Principles (Strategy) of the State Environmental Policy of Ukraine for the Period up to 2030” of 2019 No. 2697 provides for increasing the share of the area of agricultural land for extensive use (hayfields, pastures) in the total territory of the country to 15.8% in 2030[167] compared to the current level of 12.5%;
- Order of the Cabinet of Ministers of Ukraine No. 1363 of 2021 “On Approval of the Strategy of Environmental Security and Adaptation to Climate Change for the Period up to 2030” - ensuring the application of conservation tillage practices with the preservation and enhancement of soil organic matter, and among the expected results it is stated that the implementation of the Strategy will contribute to achieving a neutral level of land degradation[168];
- Order of the Cabinet of Ministers of Ukraine of 30.05.2024 No. 483 “On Approval of the Strategy for the Formation and Implementation of the State Policy in the Field of Climate Change for the Period up to 2035 and Approval of the Operational Plan of Measures for its Implementation in 2024-2026” - increasing the area of agricultural land with organic status and carbon farming, ensuring the use of drained lands with peat soils for agriculture[169]. It should be noted that the latter provision on the agricultural use of drained lands with peatlands should be subject to appropriate restrictions, including the main one - the prohibition of ploughing. Since peatlands contain a large amount of carbon (more than forests), they are recognized as the most efficient terrestrial ecosystems for storing it, while ploughing will lead to active carbon emissions;
- Order of the Cabinet of Ministers of Ukraine of 2019 No. 688 “On Approval of the Irrigation and Drainage Strategy in Ukraine for the Period up to 2030” - the priority of measures to restore and develop irrigation and drainage is determined taking into account climate and other factors; in particular, the role of irrigation in ensuring efficient and sustainable farming in the context of global changes in climate , in this regard, all existing irrigation systems in the southern region should be considered as subject to modernization[170];
- Order of the Ministry of Agrarian Policy and Food of Ukraine dated 24.11.2021 No. 382 “On Approval of the Rules for Ensuring Soil Fertility and the Use of Certain Agrochemicals”[171] - establishing undesirable periods for fertilizing the soil, determining the conditions for fertilizing near water bodies, mandatory planning of fertilization and keeping records of their use;
- Resolution of the Cabinet of Ministers of Ukraine dated 22.07.2020 No. 650 “On Approval of the Rules for the Maintenance and Preservation of Shelterbelts Located on Agricultural Land” - basic requirements for the maintenance and preservation of these

[166] Order of the Cabinet of Ministers of Ukraine of 2022 No. 70 "On Approval of the Concept of the National Target Programme for Land Use and Protection". https://zakon.rada.gov.ua/laws/show/70-2022-%D1%80#Text.

[167] The Law of Ukraine "On the Basic Principles (Strategy) of the State Environmental Policy of Ukraine for the Period up to 2030". https://zakon.rada.gov.ua/laws/show/2697-19#Text

[168] Order of the Cabinet of Ministers of Ukraine of 2021 No. 1363 "On Approval of the Strategy for Environmental Security and Adaptation to Climate Change for the Period up to 2030". https://zakon.rada.gov.ua/laws/show/1363-2021-%D1%80#Text

[169] On Approval of the Strategy for the Formation and Implementation of the State Policy in the Field of Climate Change for the Period up to 2035 and Approval of the Operational Plan of Measures for its Implementation in 2024-2026, Order of the Cabinet of Ministers of Ukraine of 30.05.2024 No. 483. https://zakon.rada.gov.ua/laws/show/483-2024-%D1%80#Text.

[170] Order of the Cabinet of Ministers of Ukraine of 2019 No. 688 "On Approval of the Strategy of Irrigation and Drainage in Ukraine for the Period up to 2030". https://zakon.rada.gov.ua/laws/show/688-2019-%D1%80?find=1&text=%D0%B0%D0%B4%D0%B0%D0%BF%D1%82%D0%B0%D1%86%D1%96%D1%97+%D0%BA%D0%BB%D1%96%D0%BC%D0%B0%D1%82%D1%83#w2_1

[171] Order of the Ministry of Agrarian Policy and Food of Ukraine of 24.11.2021 No. 382 "On Approval of the Rules for Ensuring Soil Fertility and the Use of Certain Agrochemicals". https://ips.ligazakon.net/document/re37370.

forest strips, a set of measures to ensure the performance of agroforestry reclamation functions [172];

- Resolution of the Cabinet of Ministers of Ukraine of 19.01.2022 No. 35 “On Approval of the Procedure for Land Conservation” - to carry out reclamation, reforestation, or renaturalisation of degraded, low-productive, technogenically contaminated lands [173];
- Resolution of the Cabinet of Ministers of Ukraine of 23 July 2024 No. 848 “On Approval of the Procedure for Monitoring of Land and Soils”[17(9)].

[172] Resolution of the Cabinet of Ministers of Ukraine dated 22.07.2020 No. 650 "On Approval of the Rules for the Maintenance and Preservation of Shelterbelts Located on Agricultural Land". https://zakon.rada.gov.ua/laws/show/650-2020-%D0%BF#Text.

[173] Resolution of the Cabinet of Ministers of Ukraine of 19.01.2022 No. 35 "On Approval of the Procedure for Land Conservation. https://zakon.rada.gov.ua/laws/show/35-2022-%D0%BF#Text

Annex 3.
GAEC standards and SMR requirements in the EU

GAEC standards and SMR requirements in the EU. Enhanced conditionality[174] within the framework of the EU's Common Agricultural Policy (CAP) for the 2023-2027 programme period is aimed at encouraging farmers to comply with high EU standards in terms of public health and welfare, plant and animal welfare, climate adaptation, and biodiversity conservation. Fruit and nut producers also must comply with SMR and GAEC standards in order to qualify for financial support payments from EU CAP funds and national funds.

The conditionality mechanism is regulated by Regulation (EU) 2021/2115, section 2. To receive financial support for sustainable development incomes, farmers must comply with the following basic rules of enhanced conditionality, including

- Statutory management requirements (SMR);
- Good agricultural and environmental conditions (GAEC) standard.

Member states include a system of conditions for farmers in their CAP strategic plans. If farmers do not comply with SMR and GAEC standards, they lose direct and other payments.

The SMRs are based on 11 EU legal acts (9 directives and 2 regulations) and relate to climate and environment, public health, farm animals and plants, and their protection. Of the eleven SMRs, seven relate to crop production and four to livestock production.

The GAEC standards are an important tool for guiding EU agriculture towards sustainability. List of GAECs:

GAEC 1. Maintenance of permanent pastures;

GAEC 2: Protection of bogs and peatlands;

GAEC 3. Prohibition of stubble burning on arable land;

GAEC 4. Arrangement of protective strips along watercourses;

GAEC 5. Manage soil cultivation and reduce the risk of soil degradation and erosion;

GAEC 6. Minimum ground cover during the most sensitive periods;

GAEC 7. Crop rotation on arable land;

GAEC 8. Maintaining non-productive functions to enhance biodiversity;

GAEC 9. Prohibition of conversion or ploughing of pastures in Natura 2000 sites.

For the period of 2022-2024, the EU has regulated deviations from the defined (for 2023-2027) GAEC standards. The main reasons given are the need to increase the EU's agricultural production potential in the context of the war and to reduce the administrative burden on farmers. Therefore, the requirements for most GAECs have been relaxed.

Ukraine has several legal requirements for business operations in the context of EU GAAP that are more or less compliant with them; these requirements are not linked to the system of financial support to agricultural producers under government programmes. An assessment of the compliance of Ukrainian legislation with EU GAAP standards (to be carried out in the next stage) is important to identify gaps and the level of approximation to these standards.

It is recommended to continue to develop the legal framework in Ukraine to regulate proper agricultural and environmental conditions for agricultural production in the context of the EU GAEC standards prioritized by the European community.

Ukrainian standards for processing fruits, berries and nuts

- GOST 23285-78 Transport bags for foodstuffs and glass containers. Technical specifications (Packages for foodstuffs and glass containers. Technical specifications)
- GOST 13799-81 Canned fruit, berry, vegetable and mushroom products. Packaging, labelling, transportation and storage (Canned fruit, berry, vegetable and mushroom products. Packaging, labelling, transport and storage)

[174] Regulation (EU) 2021/2115 of the European Parliament and of the Council of 2 December 2021 establishing rules on support for strategic plans to be drawn up by Member States under the common agricultural policy (CAP Strategic Plans) and financed by the European Agricultural Guarantee Fund (EAGF) and by the European Agricultural Fund for Rural Development (EAFRD) and repealing Regulations (EU) No 1305/2013 and (EU) No 1307/2013. URL: https://eur-lex.europa.eu/eli/reg/2021/2115/oj?locale=en.

- GOST 25555.3-82 Fruit and vegetable processing products. Methods for determining mineral impurities (Products of fruit and vegetable processing. Methods for determination of mineral impurities)
- GOST 26313-84 Fruit and vegetable processing products. Rules of acceptance. Methods of sampling.
- GOST 26323-84 Fruit and vegetable processing products. Methods for determining the content of impurities of plant origin (Products of fruit and vegetable processing. Methods for determining the content of impurities of plant origin)
- GOST 26671-85 Processed fruit and vegetable products, canned meat and vegetable products. Preparation of samples for laboratory analysis
- GOST 27572-87 Fresh apples for industrial processing. Technical conditions (Fresh apples for industrial processing. Technical conditions)
- DSTU 2074-92 Vegetable and fruit processing products. Terms and definitions.
- DSTU 3235-95 Equipment of the vegetable and fruit processing industry. Safety requirements.
- GOST 29270-95 Products of fruit and vegetable processing. Methods of determination of nitrates (Products of fruit and vegetable processing. Methods of determination of nitrates)
- DSTU 4283.1:2007 DSTU 4283.2:2007. Juices and juice products.
- DSTU 4734:2007 Fruit and berry ice cream, aromatic, sherbet, ice. General technical conditions. With changes and amendments
- DSTU 4837:2007 Frozen fruits and berries. Technical specifications

DSTU 4898:2007 Canned food. Fruit mashed or chopped. Specifications.

DSTU 4899:2007 Jam. General technical conditions

DSTU 4900:2007 Jams. General technical conditions

DSTU 4941:2008 Processed fruit and vegetable products, canned meat and meat and vegetable products. Methods for determination of fat content

DSTU 6072:2009 Jam. General technical conditions

DSTU 6087:2009 Canned food. Fruit sauces. Technical specifications

DSTU 6090:2009 Concentrated semi-finished products. Fillers from fruits and vegetables. Technical specifications

DSTU 6094:2009 Fruit jellies. Technical specifications

DSTU 7159:2010. Canned juices have been reconstituted.

DSTU 7998:2015 Canned fruit and vegetable products for special dietary use in baby food. Technical specifications

DSTU 8010:2015 Canned food. Fruit and berry pastes. Technical specifications

DSTU 8057:2015 Canned food. Fruit and vegetable additives for the enrichment of baby food products. Technical specifications

DSTU 8058:2015 Canned fruit, vegetable and fruit products with biologically active ingredients for dietary use in baby food. Technical specifications

DSTU 8074:2015 Canned food. Juices and juice products. Cocktails. General technical conditions

DSTU 8686.2:2016 Soft ice cream and mixtures for its production. General technical conditions. Part 2. Soft ice cream

DSTU 9126:2021 Concentrated fruit juices. Technical conditions

EU standards for the processing of fruits, berries, and nuts

- European Parliament and Council Directive 94/62/EC of 20 December 1994 on packaging and packaging waste
- Council Directive 2001/112/EC of 20 December 2001 on fruit juices and certain similar products intended for human consumption
- Council Directive 2001/113/EC on fruit jams, jellies, marmalades and sweetened chestnut purees intended for human consumption.
- Regulation EC 1935/2004 (on materials and articles intended to come into contact with food)
- Commission Regulation (EC) No 2073/2005 (OJ L-338 22/12/2005) (CELEX 32005R2073) on the inspection of fruits and berries for pesticides, salmonella and E. coli bacteria.
- Commission Regulation (EC) No 37/2005 of 12 January 2005 on the monitoring of temperature conditions in vehicles and in storage facilities for the storage of quick-frozen foodstuffs intended for human consumption.
- Commission Regulation (EC) No 1881/2006 of 19 December 2006 setting maximum levels for certain contaminants in foodstuffs (OJ L-364 20/12/2006) (CELEX 32006R1881)
- Directive 2012/12/EU of the European Parliament and of the Council of 19 April 2012 amending Council Directive 2001/112/EC on fruit juices and certain similar products intended for human consumption
- Directive (EU) 2019/904 of the European Parliament and of the Council of 5 June 2019 on the reduction of the impact of certain plastic products on the environment.

Annex 4.
Expanded list of climate-adapted and environmentally friendly practices in agriculture and processing industry

Common name of the practice group	Main focus of the practice group	Name of the practice subgroup	Areas of practice implementation
AGRICULTURE			
Environmental practices ***Sustainable land management*** ***Focus*** Minimizing negative impact on ecosystems and reducing chemical use	Preserving and restoring the environment Soil erosion control Preserving soil fertility Ensuring biodiversity Reducing GHG emissions	Agricultural measures to minimize negative impacts on ecosystems	Creation of sustainable agricultural landscapes by creating field protection strips to reduce wind speed and water flow, as well as to provide additional shade
			Crop rotation to reduce soil fatigue and control pests
			Use of cover crops for soil and water conservation
			Composting
			Determination and implementation of the optimal technology for specific conditions (taking into account soil characteristics, type of plantations, water supply, etc.) for soil maintenance in the aisles of orchards: steam (black steam), steam green manure, and sod-manure
			Precision farming is a system of agricultural production management that takes into account the specifics of a particular region, which saves resources and minimizes environmental damage. The use of drones and satellites to monitor the condition of plants and soil, as well as the use of software for remote data processing and interpretation (allows you to process only those areas that need it)
		Regulation of the use of chemical plant protection products in agrocenoses	Reducing the use of pesticides in gardens, berry fields, and greenhouses
			Use of biological fertilizers and plant protection products
		Nutrient management	Precision fertilization to increase soil fertility and reduce GHG emissions
		Organic production	Implementation of certified activities for the production of apples, raspberries, wild strawberries, and walnuts in compliance with the requirements of the legislation in the field of organic production, circulation, and labelling of organic products
Climate-adapted practices ***Focus*** Making agriculture resilient to climate ***change***	Reducing the dependence of production on negative climatic conditions	Selection in horticulture, berry and nut growing	Identification of the list and transition to the cultivation of climate-resistant and regionally adapted varieties of apples, raspberries, strawberries, and walnuts (resistant to drought, salinity, high temperatures, or other extreme climatic conditions)
			Use of disease and pest resistant crops to reduce the need for pesticides in the face of climate change
		Agrovoltaics	Generation of solar energy to ensure the operation of drip irrigation systems, greenhouses, and processing facilities; an additional source of shading for fruit and berry plantations. Advantages: - Reducing electricity costs; - Increasing vegetation productivity and protecting crops from weather conditions; - Improving soil quality through shading and moisture.
		Water-saving irrigation systems	Implementation: - precision and drip irrigation systems to optimize irrigation depending on the temperature and soil moisture level in orchards and berry gardens; - rainwater collection and storage systems and water treatment and recycling systems
			Creating an environmentally friendly drainage system: proper water infiltration prevents flooding and waterlogging, helps to avoid chemical leaks and excess water, which saves resources and prevents soil erosion.
		Aeroponics	Implementation of a soilless system for growing berry crops in a closed environment
		Protective systems for orchards and berry nurseries	The use of nets for protection against hail, birds, and insects (nets protect against hail, and if the system is protected and forms a so-called cage on the sides, it additionally protects plantations from birds and insects);
			Application of films for protection against hail and rain
			Use of integrated mesh and film systems (e.g., Power Flex) as an integrated system for protection against hail, rain, birds, and insects. This system allows to reduce the use of chemicals (primarily herbicides and fungicides) due to the closed nature and the ability to regulate the system; minimize the risk of spreading fungicidal infections carried by insects and damage from their harmful effects; regulate ripening by speeding up or slowing down the process; protect trees, flowers and fruits from sunburn, wind, and frost
			Application of protective systems for each row of plantations to ensure individual/autonomous protection of each row (practiced in Europe). This approach combines the use of film on top and mesh on the bottom, as well as arched structures (disadvantages: relatively high cost and significant labor intensity during installation)
		Agricultural measures aimed at adapting plants to climate change	Early warning systems to change the time of planting or cultivation to avoid extreme weather conditions during critical phases of plant growth. Field analytics based on satellite imagery, use of meteorological data to reduce the negative impact of climate change on agriculture
			Mulching as a soil moisture conservation technology
			Use of cover crops to prevent soil erosion, retain water, and fix nitrogen
			No-till tillage. Prevents soil erosion and promotes carbon sequestration, thereby reducing the impact of agriculture on climate change; reduces the cost of tillage and maintenance of agricultural machinery

Annex 5.
Comparison of Ukrainian, EU, and Green Deal standards for sustainable fruits, berries, nuts, and products of their processing, and recommendations for the implementation of relevant EU regulations in Ukraine

Regulatory frameworks and standards in Ukraine and the EU for agricultural production and trade

When exporting to the EU berries, fruits, nuts and products of their processing, exporters must comply with legal and market requirements.

- Legal requirements include:
- Sanitary and phytosanitary measures (SPS):
  - general EU sanitary and hygienic standards (HACCP certification or equivalent),
  - control of contaminants in foodstuffs,
  - control of pesticide residues.
- Technical regulations, marketing standards and labeling:
  - UNECE standards,
  - special marketing standard for apples,
  - special marketing standard for strawberries.
  - Market requirements (voluntary standards) include:
  - standards for organic products,
  - GLOBALG.A.P market standards,
  - private retail network standards.

In accordance with Article 319 of the Customs Code of Ukraine, the Cabinet of Ministers of Ukraine, by its Resolution No. 960 dated October 24, 2018[175], approved the list of goods subject to phytosanitary control when imported into the customs territory of Ukraine, including apples, raspberries, and strawberries.

Requirements for market operators who produce food products on the territory of Ukraine for the purpose of their export are regulated by the norms of the Law of Ukraine “On Basic Principles and Requirements for the Safety and Quality of Food Products”[176], according to which the market operator should take the following steps:

- Implement HACCP systems (ISO 22000).
- Ensure traceability.
- Obtain the results of laboratory tests, if required in the country of destination, and obtain an international certificate. The competent authority in Ukraine currently recognizes the results of state and/or authorized private laboratories accredited according to the ISO17025 standard. The procedure for issuing international certificates is regulated by the norms of Part 8, Article 60 of the Law of Ukraine “On basic principles and requirements for the safety and quality of food products”.

When importing fruits and berries to Ukraine, the importer must have an international phytosanitary certificate.

[175] Some issues of carrying out official control measures of goods imported into the customs territory of Ukraine (including for the purpose of transit). Resolution of the Cabinet of Ministers of Ukraine No. 960 dated October 24, 2018. https://zakon.rada.gov.ua/laws/show/960-2018-%D0%BF#Text

[176] Law of Ukraine "On Basic Principles and Requirements for the Safety and Quality of Food Products". https://zakon.rada.gov.ua/laws/main/771/97-%D0%B2%D1%80#Text

Specific regulations for berries, fruits, nuts, and products of their processing

Control of contaminants in foodstuffs

Contaminants may be present in food (including berries, fruits, nuts and products of their processing) as a result of the various stages of its production, packaging, transport or holding, or also might result from environmental contamination. Council Regulation (EEC) No 315/93 of 8 February 1993[177] laying down Community procedures for contaminants in food, regulates the presence of such contaminants in foodstuffs in the EU:

- food containing a contaminant to an amount unacceptable from the public health viewpoint and in particular at a toxicological level, shall not be placed on the EU market and will be rejected;
- contaminant levels should be kept as low as can reasonably be achieved following recommended good working practices;
- maximum levels may be set for certain contaminants in order to protect public health.

New Commission Regulation (EU) 2023/915 of 25 April 2023 on maximum levels for certain contaminants in food[178] replacing Regulation (EC) 1881/2006 sets maximum levels in foods to be placed on the EU market for mycotoxins, vegetable toxins, metals, halogenated persistent organic pollutants, process contaminants, and others. The foodstuffs listed in Annex I of the Regulation (EU) 2023/915 cannot be placed on the market, or used as raw materials or ingredients in foods, if they contain a contaminant in a quantity higher than the maximum level established in Annex I. Annex I contains the requirements for content of contaminants in fruits (metals, perchlorate), tree nuts (metals), dried fruits , tree nuts, fruit juices, fruit juices from concentrate, concentrated fruit juices and fruit nectars (mycotoxins, metals).

In Ukraine, maximum levels of certain contaminants in food products are regulated by the Order of the Ministry of Health of Ukraine “On Approval of State Hygienic Rules and Norms “Regulations on Maximum Levels of Certain Contaminants in Food Products”” No. 368 dated 05/13/2013 (last revised on 01/02/2024)[179].

Recommendations

Ukrainian legislation does not fully implement the provisions of the Commission Regulation (EU) 2023/915 of 25 April 2023 on maximum levels for certain contaminants in food. In particular, the Annex to the “Regulation on maximum levels of certain contaminants in foodstuffs” sets maximum levels for cadmium and lead in fruits at 0.05 mg/kg and 0.1 mg/kg, respectively, which corresponds to the standards for the content of these metals in fruits set out in Annex I of Commission Regulation (EU) 2023/915. However, Annex I of Commission Regulation (EU) 2023/915 separately sets maximum levels of cadmium in raspberries – 0.04 mg/kg, and in other berries, in particular, strawberries – 0.03 mg/kg. The EU regulation also sets maximum levels of cadmium in nuts (0.2 mg/kg), while the Ukrainian regulation does not regulate maximum levels of cadmium in nuts.

Control of pesticide residues

Regulation (EC) 1107/2009[180] lays down rules and procedures for active substances to be marketed in the EU and for the authorization by Member States of plant protection products containing them. Active substances cannot be used in plant protection products unless they are included in a positive EU list. Such substances are included in the EU Pesticides Database[181]. Once a substance is included in the list, Member States may authorize the use of products that contain it.

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[177] Council Regulation (EEC) No 315/93 of 8 February 1993 laying down Community procedures for contaminants in food. http://data.europa.eu/eli/reg/1993/315/oj

[178] Commission Regulation (EU) 2023/915 of 25 April 2023 on maximum levels for certain contaminants in food and repealing Regulation (EC) No 1881/2006. http://data.europa.eu/eli/reg/2023/915/2024-07-22

[179] Order of the Ministry of Health of Ukraine "On Approval of State Hygienic Rules and Norms "Regulations on Maximum Levels of Certain Contaminants in Food Products"" No. 368 dated 05/13/2013. https://zakon.rada.gov.ua/laws/show/z0774-13

[180] Regulation (EC) No 1107/2009 of the European Parliament and of the Council of 21 October 2009 concerning the placing of plant protection products on the market and repealing Council Directives 79/117/EEC and 91/414/EEC. http://data.europa.eu/eli/reg/2009/1107/oj

[181] EU Pesticides Database. https://food.ec.europa.eu/plants/pesticides/eu-pesticides-database_en

Regulation (EC) 396/2005[182] lays down provisions for the setting of EU pesticide maximum residue levels (MRLs) in food and feed. Imports of plant and animal products must comply with such MRLs set by the European Commission.

Annexes to Regulation (EC) 396/2005 set out the list of products subject to control and the MRLs applicable to them. The list of products to which the MRLs apply has been established in Annex I[183], which includes fruits, fresh or frozen, and tree nuts.

In Ukraine, the control of pesticide MRLs is regulated by the Order of the Ministry of Health of Ukraine "On approval of the Procedure for establishing maximum permissible levels of pesticide residues in/on food products and feed of plant and animal origin" dated 04.04.2023 No. 625[184]. The Order was issued with the aim of implementing Regulation (EC) No 396/2005. The pesticide MRLs are provided in Annex 2 to this Order. The relevant regulations of Ukraine partially implement the provisions of the EU regulations on pesticide MRLs.

Traceability

Food and feed business operators shall comply with the specific obligations laid down by Regulation (EC) 178/2002[185], covering all stages of food/feed production and distribution: compliance with Food Law, traceability, and responsibilities.

Imported food and feed must comply with the relevant requirements of Food Law. The competent authority of the exporting country must offer guarantees as to the compliance or equivalence with the EU requirements.

The EU Food Law defines traceability as the ability to trace and follow any food, feed, food-producing animal or substance that will be used for consumption, through all stages of production, processing and distribution. Traceability is always required for any substance intended to be, or expected to be, incorporated into food or feed. However, certain products are covered by specific EU Regulations or Directives that may even impose more stringent requirements on traceability, such as *fruits*[186] and vegetables.

The traceability requirement is contained in Article 22 of the Law of Ukraine "On Basic Principles and Requirements for the Safety and Quality of Food Products" and in accordance with Article 33 of this Law, the "Methodological Guidelines for Ensuring the Traceability of Certain Types of Food Products"[187] developed by the association of market operators "Ukrainian Agribusiness Club", have been approved. These guidelines are intended mainly for exported products. At the legislative level, requirements for the traceability of livestock products have been established[188].

Marketing standards

The competent authorities designated by the EU Member States perform documental and/or physical inspections of the imported products in order to check their conformity with the EU general marketing standards laid down in Annex I Part A[189] of Regulation (EC) 543/2011. General marketing standard defines minimum quality requirements; minimum maturity requirements; tolerance; marking of origin of produce. However, where the holder is able to show that the products are in conformity with any applicable standards adopted by the United Nations Economic Commission for Europe (UNECE), they shall be considered as conforming to the general marketing standard.

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[182] Regulation (EC) No 396/2005 of the European Parliament and of the Council of 23 February 2005 on maximum residue levels of pesticides in or on food and feed of plant and animal origin and amending Council Directive 91/414/EEC Text with EEA relevance. http://data.europa.eu/eli/reg/2005/396/oj

[183] https://webgate.ec.europa.eu/reqs2/public/v2/requirement/auxi/eu/32005R0396_heapestires_annex_1.pdf/

[184] Order of the Ministry of Health of Ukraine "On approval of the Procedure for establishing maximum permissible levels of pesticide residues in/on food products and feed of plant and animal origin" dated 04.04.2023 No. 625. https://zakon.rada.gov.ua/laws/show/z0887-23#n16

[185] Regulation (EC) No 178/2002 of the European Parliament and of the Council of 28 January 2002 laying down the general principles and requirements of food law, establishing the European Food Safety Authority and laying down procedures in matters of food safety. http://data.europa.eu/eli/reg/2002/178/oj

[186] https://webgate.ec.europa.eu/reqs2/public/v2/requirement/auxi/eu/eu_safefood_traceability_legislation.pdf/

[187] Methodological Guidelines for Ensuring the Traceability of Certain Types of Food Products https://www.sk.dpss.gov.ua/wp-content/uploads/2024/10/prostezhuvanist.pdf

[188] Order of the Ministry of Agrarian Policy and Food of Ukraine dated June 13, 2018 No. 270 "On Approval of Requirements for the Content, Form and Procedure for Providing Information on the Food Chain". https://zakon.rada.gov.ua/laws/show/z0964-18#Text

[189] webgate.ec.europa.eu/reqs2/public/v2/requirement/auxi/eu/32011R0543_mktfrveg_annex_1a.pdf/

The following fruits have specific marketing standards fixed in Annex I Part B of Regulation (EC) 543/2011: apples, citrus fruit, kiwifruit, peaches, nectarines, pears, strawberries, and table grapes. Specific marketing standards should be adopted for those products for which it seems necessary to adopt a standard based on an assessment of its relevance, taking into account, in particular, which products are most traded in value terms.

Marketing standard for *apples*[190] applies to apples to be supplied fresh to the consumer, apples for industrial processing being excluded. Marketing standard for *strawberries*[191] applies to strawberries to be supplied fresh to the consumer, strawberries for industrial processing being excluded.

Recommendations

Currently, in Ukraine, producers of fresh fruits and berries must adhere to quality standards set by the Main Institute of Standardization of Ukraine. These standards are inherited from the times of the Soviet Union and differ significantly from the standards used in the EU and the world. The EU marketing standards for apples and strawberries must be implemented in Ukraine.

Labelling of foodstuffs

All foodstuffs marketed in the European Union (EU) must comply with EU labelling rules, which aim at ensuring that consumers get all the essential information to make an informed choice while purchasing their foodstuffs.

There are two types of labeling provisions that are applicable to foodstuffs:

General rules on food labelling (Regulation (EU) No 1169/2011[192] on the labelling of foodstuffs) and specific provisions for certain groups of products, among them:

Fruit juices and similar products (Directive 2001/112/EC relating to fruit juices and certain similar products intended for human consumption.[193] It sets out specific rules regarding the composition of fruit juices, their reserved names, their manufacturing characteristics, and their labeling.

Fruit juices are labeled under the general rules laid down in Regulation (EU) No 1169/2011. However, additional, specific rules are adopted in this directive to improve consumer information. These require making it clear in the product name:

- if a product is a mixture of different fruits;
- if a product has been obtained entirely or partly from a concentrate.

Since the amending Directive 2012/12/EU[194] was adopted, the addition of sugars is no longer authorized in fruit juices.

Fruit jams and sweetened chestnut purée **(**Council Directive 2001/113/EC of 20 December 2001 relating to fruit jams, jellies and marmalades and sweetened chestnut purée intended for human consumption[195]).

The composition and labelling of fruit jams and sweetened chestnut purée are subject to specific rules regarding their fruit and sugar content, residual content of sulphur dioxide, and other permitted additives.

Quick-frozen food **(**Directive 89/108/EEC on quick-frozen foodstuffs for human

[190] https://webgate.ec.europa.eu/reqs2/public/v2/requirement/auxi/eu/32011R0543_mktfrveg_annex_1b_apples.pdf/

[191] https://webgate.ec.europa.eu/reqs2/public/v2/requirement/auxi/eu/32011R0543_mktfrveg_annex_1b_strawberries.pdf/

[192] Regulation (EU) No 1169/2011 of the European Parliament and of the Council of 25 October 2011 on the provision of food information to consumers, amending Regulations (EC) No 1924/2006 and (EC) No 1925/2006 of the European Parliament and of the Council, and repealing Commission Directive 87/250/EEC, Council Directive 90/496/EEC, Commission Directive 1999/10/EC, Directive 2000/13/EC of the European Parliament and of the Council, Commission Directives 2002/67/EC and 2008/5/EC and Commission Regulation (EC) No 608/2004 Text with EEA relevance. http://data.europa.eu/eli/reg/2011/1169/oj

[193] Directive 2001/112/EC relating to fruit juices and certain similar products intended for human consumption. http://data.europa.eu/eli/dir/2001/112/oj

[194] Directive 2012/12/EU of the European Parliament and of the Council of 19 April 2012 amending Council Directive 2001/112/EC relating to fruit juices and certain similar products intended for human consumption. http://data.europa.eu/eli/dir/2012/12/oj

[195] Council Directive 2001/113/EC of 20 December 2001 relating to fruit jams, jellies and marmalades and sweetened chestnut purée intended for human consumption. http://data.europa.eu/eli/dir/2001/113/oj

consumption).[196] Directive 89/108/EEC lays down EU-wide rules governing the quick freezing, packaging, labeling, and inspection of quick-frozen foodstuffs.

In Ukraine, food labeling is regulated by the Law of Ukraine "On Information for Consumers on Food Products" dated December 6, 2018, No. 2639-VIII [197]. Its provisions comply with the general rules on food labelling provided by EU Regulation EU No 1169/2011. However, in the first months of the war, some labeling requirements were simplified. In addition, Ukrainian legislation establishes special labeling requirements for certain food products, but processed fruit and berry products are not included in their list.

Recommendations

To harmonize Ukrainian standards with EU standards on the labeling of processed fruit products, it is necessary to implement the provisions of Directive 2001/112/EC and Council Directive 2001/113/EC into Ukrainian legislation.

In Ukraine, there is a standard for quick-frozen fruits and berries: "DSTU 4837:2007 Quick-frozen fruits and berries. Technical conditions"[198]. Directive 89/108/EEC on quick-frozen foodstuffs for human consumption must be implemented into the legislation of Ukraine.

Green Deal provisions and relevant Ukrainian indicators and standards

The F2F Strategy states that "Commission will take into account environmental aspects when assessing requests for import tolerances for pesticide substances no longer approved in the EU while respecting WTO standards and obligations" [199].

One of the first regulatory acts implementing the F2F Strategy on imported food in relation to pesticides residues is Commission Regulation (EU) 2023/334 of 2 February 2023 amending Annexes II and V to Regulation (EC) No 396/2005 of the European Parliament and of the Council as regards maximum residue levels for clothianidin and thiamethoxam in or on certain products[200].

The environmental aspects targeted by this regulation relate to the protection of bees and other pollinators. The regulation includes trade facilitating provisions, mainly to postpone the application date of the regulation to 7 March 2026.

Recommendations

Therefore, in order to export to the EU from March 2026, it is necessary to exclude clothianidin and thiamethoxam from the State Register of Pesticides and Agrochemicals approved for use in Ukraine because their removal from the market requires a certain transition period. Appropriate amendments should be made to the Order of the Ministry of Health of Ukraine "On Approval of the Procedure for Establishing Maximum Permissible Levels of Pesticide Residues in/on Food Products and Feed of Plant and Animal Origin" dated 04.04.2023 No. 625. Appendix 2 to this Procedure allows clothianidin residues in strawberries and apples, and thiamethoxam residues in strawberries, apples, and walnuts (Table 39 of Appendix 2).

The Farm to Fork Strategy announced measures for a healthier and more sustainable Union food system. By means of those measures, the Commission seeks, inter alia, to stimulate product reformulation in the case of foods high in sugars and to facilitate the shift to healthy and sustainable diets. European Commission updated some of the rules governing a set of directives on food products – the 'breakfast' directives. Changes include increasing the fruit content in jams and reducing sugar in fruit juice (Directive (EU) 2024/1438 of the European Parliament and of the Council of 14 May 2024 amending Council Directives 2001/110/EC relating to honey, 2001/112/EC relating to fruit juices and certain similar products intended for human consumption, 2001/113/EC relating to fruit jams, jellies and marmalades and sweetened chestnut purée intended for human

[196] Council Directive 89/108/EEC of 21 December 1988 on the approximation of the laws of the Member States relating to quick-frozen foodstuffs for human consumption. http://data.europa.eu/eli/dir/1989/108/oj

[197] Law of Ukraine "On Information for Consumers on Food Products" dated December 6, 2018 No. 2639-VIII https://zakon.rada.gov.ua/laws/show/2639-19#Text

[198] https://zakon.isu.net.ua/sites/default/files/normdocs/dstu_4837_2007_frukti_ta_yagodi_shvidkozamorozheni._tekhnichn.pdf

[199] European Commission, A Farm to Fork Strategy, p. 18. https://food.ec.europa.eu/system/files/2020-05/f2f_action-plan_2020_strategy-info_en.pdf

[200] Commission Regulation (EU) 2023/334 of 2 February 2023 amending Annexes II and V to Regulation (EC) No 396/2005 of the European Parliament and of the Council as regards maximum residue levels for clothianidin and thiamethoxam in or on certain Products. Official Journal of the European Union. 15.2.2023. p. 47/29. https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32023R0334.

consumption, and 2001/114/EC relating to certain partly or wholly dehydrated preserved milk for human consumption[201]). Article 6 of the Directive “Transitional measures” states that products that are placed on the market or labe led before 14 June 2026 may continue to be marketed until the exhaustion of stocks.

Recommendations

In order to export fruit juices and certain similar products, fruit jams, jellies, and marmalades intended for human consumption to the EU, Ukraine, before 14 June 2026, should implement Council Directive 2001/112/EC relating to fruit juices and certain similar products intended for human consumption, and Council Directive 2001/113/EC relating to fruit jams, jellies and marmalades and sweetened chestnut purée intended for human consumption, with the changes made by the Directive (EU) 2024/1438 of the European Parliament and of the Council of 14 May 2024.

[201] Directive (EU) 2024/1438 of the European Parliament and of the Council of 14 May 2024 amending Council Directives 2001/110/EC relating to honey, 2001/112/EC relating to fruit juices and certain similar products intended for human consumption, 2001/113/EC relating to fruit jams, jellies and marmalades and sweetened chestnut purée intended for human consumption, and 2001/114/EC relating to certain partly or wholly dehydrated preserved milk for human consumption. http://data.europa.eu/eli/dir/2024/1438/oj