

## **Changes in the Vegetable Oil Market, with Particular Emphasis on Market Instability in Relation to the War in Ukraine**

**Abstract.** In the 21st century, the global production and consumption of oilseeds and their processing products are growing dynamically as a result of the globally growing demand for food and renewable energy. Globally, supply and demand factors have changed the edible vegetable oils industry. The production of vegetable oils is characterized by one of the highest dynamics among all agricultural raw materials, which results from the growing demand for vegetable oils for food, industrial purposes and the growing demand for protein feed. The cultivation of oilseeds plays an important role in Polish agriculture. On an industrial scale, the production of rapeseed oil dominates in Poland, and is a strategic product of the Polish agri-food sector. Sunflower and soybean oils are also of market importance. The scale of crude rapeseed oil production ranks Poland third in the European Union (after Germany and France) and sixth in the world. The country's share in EU rapeseed oil production is about 13%. Poland, despite the dynamic development of rapeseed production and processing which took place after 2004, has low self-sufficiency in the field of oilseed products, especially low in the field of oilseed meals (self-sufficiency at the average level of approx. 43% in 2018-2020) and oils vegetable crops (self-sufficiency at the average level of approx. 63%); therefore, it remains a permanent, large net importer.

**Key words:** edible oils, rapeseed oil, sunflower oil, oils market, edible oils market, vegetable oils, war in Ukraine

**JEL Classification:** D40, Q02

### **Introduction**

Oilseeds play a significant role in the world's agriculture, food economy and processing industries. They are the raw material for production of consumer and technical fats, they are a source of food and feed protein, and some of them, such as cotton and linen, also provide plant fiber (Rosiak, 2014). They are an essential element of the agri-food sector. And the industry itself, as noted by Drejerska and Fiore (2022), as part of the agri-food sector, plays a crucial role in the global economy. It is directly related to the livelihoods of almost eight billion people.

Consequently, the issue of the current situation in the market of edible vegetable oils is an important topic. In the 21st century, the global production and consumption of oilseeds and their processing products (vegetable oils and oilseed meals) is dynamically growing, as a result of the growing demand for food and renewable energy on a global scale. At the same time, the growth rate varies regionally (Rosiak, 2018, 2019). This increase is due to the growing interest in using vegetable oils for both food and industrial purposes.

Vegetable oils are fats of vegetable origin that have a liquid consistency at room temperature (an exception is, for example, coconut oil). In chemical terms, vegetable oils are triglycerides; an ester bond connects three molecules of fatty acids with a molecule of

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glycerol. Humans have used vegetable fats for years. These fats have found application in many areas of life, e.g., in nutrition, dietetics, medicine, cosmetology, tribology and as alternative fuels (Szczyńska, 2019, Zielińska and Nowak, 2014). Vegetable oils are noble natural raw materials that are used in many ways. The first is human nutrition, for whom rapeseed and sunflower oils have well-established nutritional properties (Pilorgé and Muel 2016). As indicated in the literature, commonly used vegetable oils – sunflower oil, soybean oil, low erucic rapeseed oil, and olive oil – have the highest nutritional value in everyday use (Goryńska-Goldmann, 2005). Edible vegetable oils are versatile and can be used in products such as fried foods, mayonnaises, margarines, shortenings, pharmaceuticals, and biofuels. Typical cooking oils include soybean, canola, palm, corn, coconut, cottonseed, olive, and sunflower. The choice of edible vegetable oil for a particular application depends on the price and the fatty acid profile, which indicates the features and benefits of the oil. (Smith, 2005; Shahidi, 2005; Parcell et al., 2018).

Globally, supply and demand factors have transformed the edible vegetable oil industry (Parcell et al., 2018). The production of vegetable oils is characterized by one of the highest dynamics among all agricultural raw materials, which results from the growing demand for vegetable oils for food and industrial purposes and the increasing demand for protein feed (Boczar, 2012). The market for vegetable oils is believed to be saturated regarding household demand for these oils. The low-income elasticity of demand for vegetable fats also evidences saturation. According to various authors, this value was at the level of 0.1 and lower. Such a low level of this ratio indicates that the needs for vegetable fats in households are primarily satisfied and that no significant increase in the consumption of these products is expected due to an increase in income. (Rosiak 2006, Gulbicka, Kwasek 2000; 2001; 2006; Laskowski 2014; Boczar, Goryńska-Goldmann, 2005; Boczar, Błażejczyk-Majka, 2018). In recent years, a substantial proportion of edible oils has been sunflower oil due to its high nutritional quality and desirable industrial functionality (Domínguez Brando and Sarquis, 2012). Historically, sunflower oil has been considered a premium oil, with average prices generally significantly higher than soybean and rapeseed oil until 2016. (Oil World, 2019). Rapeseed oil is primarily characterized by a favorable composition of fatty acids – the lowest content of saturated acids and the highest content of unsaturated acids, including n-3 acids (Krygier, 2009).

Sunflower cultivation is currently limited to southern Europe and Central/Eastern Europe, mainly due to temperature (Debaeke et al. 2017). Sunflower is produced on a large scale in a limited number of countries, with two-thirds of production concentrated in Europe, including Ukraine and Russia, and in the Trakia region of Turkey. Other major producing countries include Argentina, China, the United States and Southeast Africa (South Africa, Tanzania, Uganda, and Zambia) (Pilorgé, 2020). It should be noted that Russia and Ukraine have a 50% share of the global sunflower oil market and are at the forefront of rapeseed oil supplies (Zavorotniy and Bilyk, 2017, Kuts and Makarchuk, 2020, FAO, 2020 ). Currently, rapeseed ranks second in the world in the cultivation of oilseeds, after soybean. Regarding the amount of oil produced, it ranks third, after palmitic and soybean oil. The largest world producer of rapeseed is the European Union. Its crops account for 34% of global production, which is 19-20 million tons per year. China, Canada, India, Ukraine, and Australia follow it. Compared to other European Union countries, Poland ranks third, after Germany and France (Gugała et al. 2014).

In the context of the edible oils market, it should be noted that Ukraine is also one of the five largest global exporters of rapeseed, sunflower oil, and sunflower meal. It should be

noted that the supplies of sunflower oil from Ukraine have practically stalled due to logistical problems related to the armed conflict. And given the significant share of Ukrainian exports in the global oil market, any supply disruption will have serious consequences for oil importers. This means that the effects of the conflict will extend beyond the sunflower oil sector, with a temporary impact on the markets of other vegetable oils. The OECD-FAO agricultural forecast for 2019-2028 believes that vegetable oil prices should increase (OECD-FAO, 2019; Zolotnytska, Kowalczyk, 2022).

The cultivation of oilseeds plays a vital role in Polish agriculture. On an industrial scale, the production of rapeseed oil dominates in Poland, which is a strategic product of the Polish agri-food sector. Sunflower and soybean oils are also of market importance. The crude rapeseed oil production scale ranks Poland third in the European Union (after Germany and France) and sixth in the world. The country's share in EU rapeseed oil production is around 13% (Polish Association of Oil Producers, 2021). Poland, despite the dynamic development of rapeseed production and processing which took place after entry to the EU in 2004, has low self-sufficiency in the field of oilseed products, especially low in oilseed meals (self-sufficiency at the average level of approx. 43% in 2018-2020) and oils crops (self-sufficiency on average around 63%). Therefore, it remains a permanent, sizeable net importer (Kapusta, 2022).

## **Material and methods**

The purpose of this article was to present the changes that have taken place in the edible vegetable oils market in recent years, with particular emphasis on trade between the European Union and Poland with Ukraine. Attention was paid to the transformation of the market as a result of the war in Ukraine. These changes were assessed based on monthly data for selected periods. To present the general situation on the vegetable oil market, data from IEGRiGŻ PIB reports from 2015-2022, and Euromonitor International 2022 and Oil World data from 2019-2022 were used. To assess the impact of the war in Ukraine on the situation in the EU and Polish markets, data from the European Commission's data bank, i.e., Oilseeds and Protein Crops Trade, Directorate-General for Agriculture and Rural Development, section Trade, were used. To illustrate these changes, monthly data on the level of imports of selected oils by Poland and the EU from Ukraine were used, as well as monthly data showing the export of rapeseed oil by Poland from Ukraine. Bearing in mind the significant importance of Ukraine in the production of oilseeds and the oil itself, the import of two oils by the EU with the most significant importance in the trade relationship between Ukraine and the EU and Poland, i.e., rapeseed oil and sunflower oil, was analyzed.

The data analysis process in this study entails utilizing monthly data for selected periods to assess the changes in the vegetable oil market. The following steps were undertaken to conduct the analysis:

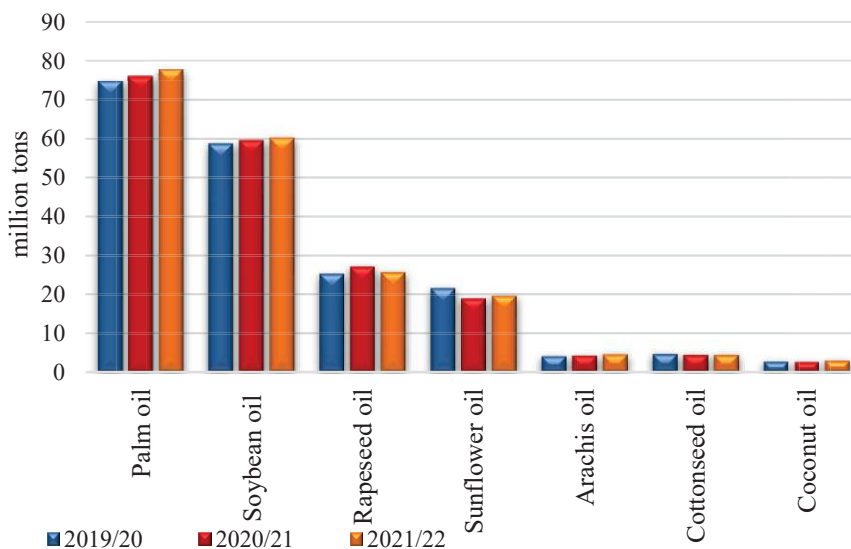
1. Data collection: Monthly data pertaining to the import of specific oils from Ukraine by Poland and the European Union (EU), as well as the export of rapeseed oil from Poland to Ukraine, were gathered. These data points were sourced from the aforementioned databases.
2. Data cleaning and preparation: The collected data were meticulously scrutinized for inconsistencies, missing values, and outliers. Necessary corrections and adjustments were applied to ensure data integrity and accuracy.

3. Data transformation: The collected monthly data was organized and transformed into a format suitable for analysis. This involved structuring the data as a time series, with each observation representing a distinct month within the chosen periods.
4. Descriptive analysis: Descriptive statistics, encompassing measures of central tendency and variability, were computed to summarize the data. These statistics provided a comprehensive overview of the distribution and characteristics of the imported and exported oils.
5. Interpretation of results and conclusion: The analyzed data and statistical findings were interpreted to comprehend the implications of the observed changes in the vegetable oil market. The results were meticulously analyzed within the context of the war in Ukraine, taking into consideration its potential influence on market instability.

## Results

### Changes in the vegetable oils market

According to the Oil World forecast from May 2022 and the IERiGŻ, production of 8 main vegetable oils (palm, soybean, rapeseed, sunflower, cotton, peanut, palm kernel and coconut) will amount to 203.5 million tons and will be 1.4% higher than in the previous season, which is the highest level in history (IERiGŻ, 2022).



\* 2021/2022 Oil World estimate

Fig. 1. World production of vegetable oils (in million tons)

Source: Authors' own study based on IEGRIGŻ National Research Institute and Oil World data.

As indicated by the data analysis, palm oil production has been most important in the global production of edible oils over the last few years. In the marketing years 2021/22, it reached the level of 77.64 million tons and was thus 17.54 million tons higher than in the case of soybean oil, which ranked second in the world ranking of vegetable oil production (Figure 1). Rapeseed oil production ranked third. It should be noted, however, that despite the significant importance of this oil in the global production of edible oils, this level is lower than in the previous two. In the marketing years 2019/20 - 2021/22, this production amounted to 26.04 million tons on average per year.

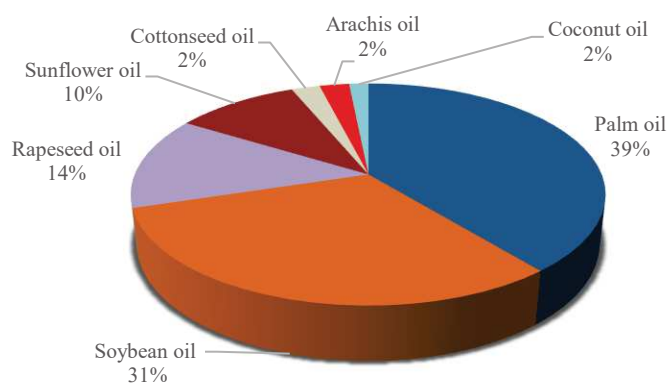


Fig. 2. The structure of vegetable oil consumption in the world (%)

Source: IERiGŻ NRI based on Oil World data.

Table 1. Foreign trade in oil products in Poland (in thousands of tons)

	2015	2016	2017	2018	2019	2020	2021 <sup>a)</sup>	2022 <sup>b)</sup>
<b>Export</b>								
<b>Vegetable oils</b>	<b>539,0</b>	<b>473,4</b>	<b>178,7</b>	<b>136,5</b>	<b>185,5</b>	<b>232,4</b>	<b>286,8</b>	<b>290,0</b>
rapeseed oil	526,1	449,7	141,0	82,4	98,3	84,7	109,8	115,0
<b>Import</b>								
<b>Vegetable oils</b>	<b>551,8</b>	<b>635,4</b>	<b>751,7</b>	<b>804,5</b>	<b>932,1</b>	<b>1078,7</b>	<b>1033,3</b>	<b>870,0</b>
palm oil	223,2	240,6	252,7	265,9	283,3	251,9	247,7	250,0
sunflower oil	55,1	51,2	150,3	154,9	209,4	301,7	207,8	180,0
soybean oil	93,5	107,0	116,5	133,6	193,3	228,8	226,9	230,0
rapeseed oil	122,4	147,2	163,2	181,4	178,4	203,5	243,0	210,0
<b>Turnover balance</b>								
<b>Vegetable oils</b>	<b>-12,8</b>	<b>-162,0</b>	<b>-573,0</b>	<b>-668,0</b>	<b>-746,6</b>	<b>-846,3</b>	<b>-746,5</b>	<b>-580,0</b>
rapeseed oil	403,7	302,5	-22,2	-99,0	-80,1	-118,8	-133,2	-95,0

Source: Authors' own study based on European Commission data.

Similar trends can be seen in the case of vegetable oil consumption. The analysis of their consumption structure indicated that the most frequently consumed vegetable oil in the world is palm oil (37%) (Figure 2). The second and third place was taken by soybean oil (30%) and rapeseed oil (13%). It should be noted that this list includes oils consumed directly by households and those consumed by purchasing products that contain the above oils.

In 2015-2022, the Polish export of vegetable oils was characterized by significant variability in individual years. This export mainly concerned rapeseed oil (Table 1). The situation related to the import of vegetable oils was different, where an upward trend is visible in the years 2015-2022. In 2021, the import of vegetable oils was almost twice as high. The most significant increase concerned imports of sunflower oil (almost four times). This contributed to the negative balance of foreign trade in vegetable oils, which increased over 58 times in 2015-2021. A slightly different situation occurred in 2022, where the import of oils, mainly sunflower and rapeseed, decreased significantly. In this case, the effects of the war can be seen, i.e., a decrease in imports from Ukraine and Russia, the main producers of sunflower and rapeseed oil.

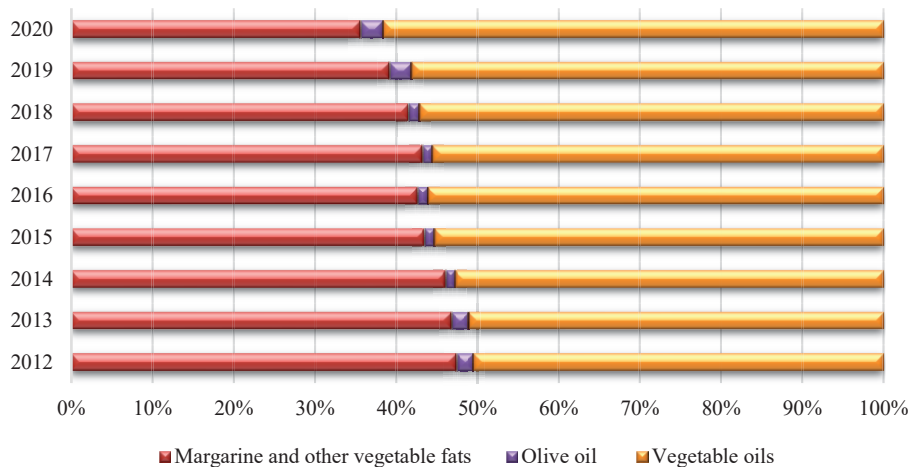


Fig. 3. Average monthly consumption of fats in households in kg/l per capita (according to family budget surveys) in Poland

Source: IERiGŻ NRI based on data from the Central Statistical Office.

As suggested by the above data, despite the dynamic development of rapeseed production and processing, Poland has low self-sufficiency in producing vegetable oils (approx. 57-64%) and therefore remains a permanent, sizeable net importer of them. This is due to the limited possibilities of developing the production of oilseeds and the growing demand for vegetable oils (including technical oils due to the development of biofuel production). It should be noted that since 2017 Poland has become a net importer of rapeseed oil, despite the growing production of rapeseed. The analysis of the average monthly consumption of fats in households in kg/l per capita showed that in the years 2015-2020 the share of vegetable oils was gradually increasing. A similar situation occurred in the case of olive oil. However, the share of margarine and other vegetable fats decreased (Figure 3).

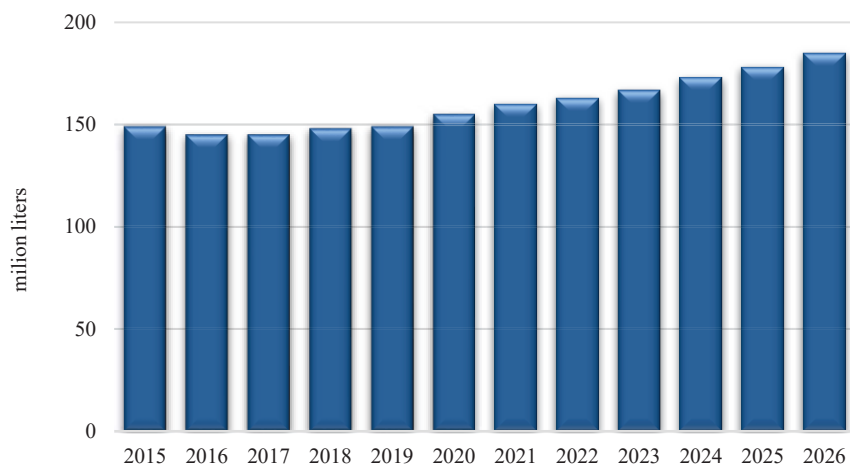


Fig. 4. Forecasts of retail sales of vegetable edible oils in Poland

Source: Euromonitor International 2022.

Forecasts provided by "Euromonitor International" indicate that the volume of retail sales of edible oils in Poland will gradually increase in the coming years. (Figure 4).

### **The impact of the war in Ukraine on the market of vegetable oils**

Due to the significant importance of Ukraine in the supply of vegetable oils, changes in the export of three vegetable oils of the greatest importance in the trade relationship between Ukraine and the EU and Poland were analyzed. It should be noted that significant differences in individual months characterize imports of rapeseed oil by the EU from Ukraine. The peak for imports, in this case, falls in August-November. The analysis of data from the 2019/2020-2022/2023 marketing years showed that 2021/2022 turned out to be a record year in this period, where the import level of rapeseed oil amounted to 120,831 t and was more than twice as high as in the previous year (Figure 5). It should be noted, however, that this situation changed dramatically after the outbreak of the war in Ukraine. With the escalation of the conflict, the amount of rapeseed oil imported by the EU from Ukraine was successively decreasing. In June 2022, the amount of imported rapeseed oil was three times lower than in the previous year. A similar situation occurred in the following months, July 2022 - November 2023. In these months, the level of imports was, on average, five times lower than in the corresponding months of the previous year. This situation, among others, should be considered, in the problems in exports from Ukraine resulting from the conflict and the decline in production caused by the same factor.

Despite the numerous problems in the export of sunflower oil from Ukraine after Russia's aggression, this disturbance was short-lived in the case of the European Union. The decrease in EU sunflower oil imports from Ukraine in the 2021/2022 marketing years fell in March - May 2022, and then these imports stabilized (Figure 6). It should be noted that despite the challenging market situation, the level of imports of sunflower oil by the EU from Ukraine in June 2022 - December 2022 was higher than in the same months in 2021.

The situation in January 2023 was different. When this import was more than two times lower than in January 2022 and, on average, by 40% compared to January 2021, this loss may result from a decrease in the sunflower harvest in 2022 resulting from the decline in crops. It should be noted that sunflower production in Ukraine is located mainly in the eastern part of the country, i.e., the area of increased fighting. It can therefore be expected that in the coming months, the trend observed in January 2023 may continue.

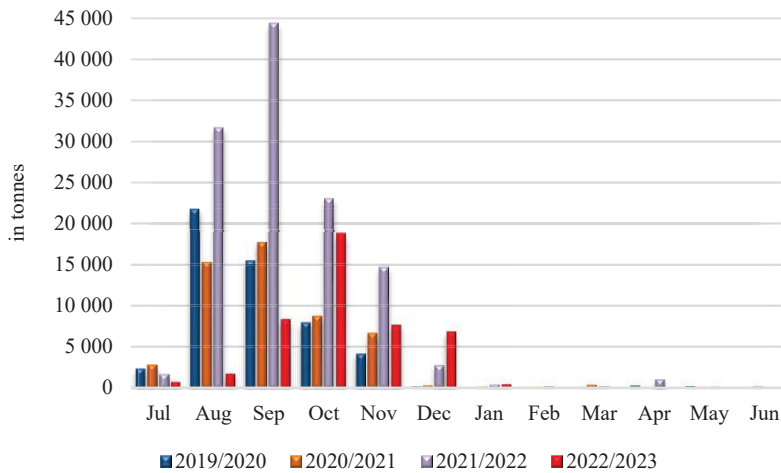


Fig. 5. Imports rapeseed oil by the EU from Ukraine (in tons)

Source: Authors' own study based on European Commission data.

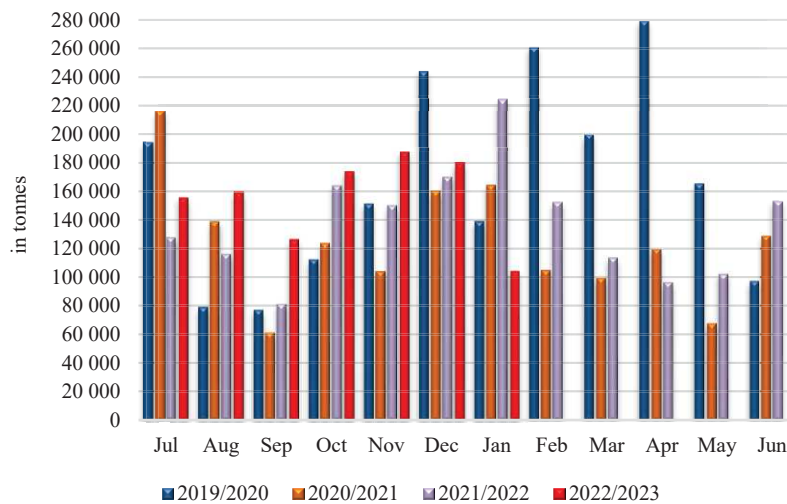


Fig. 6. Imports sunflower oil by the EU from Ukraine (in tons)

Source: Authors' own study based on European Commission data.



The analysis of the level of imports of rapeseed oil by Poland from Ukraine in the last three marketing years showed that in July - September 2022, the level of imports of this oil decreased significantly compared to previous years in these months. Compared to the same period in 2021, there was a decrease of over 50% (Figure 7).

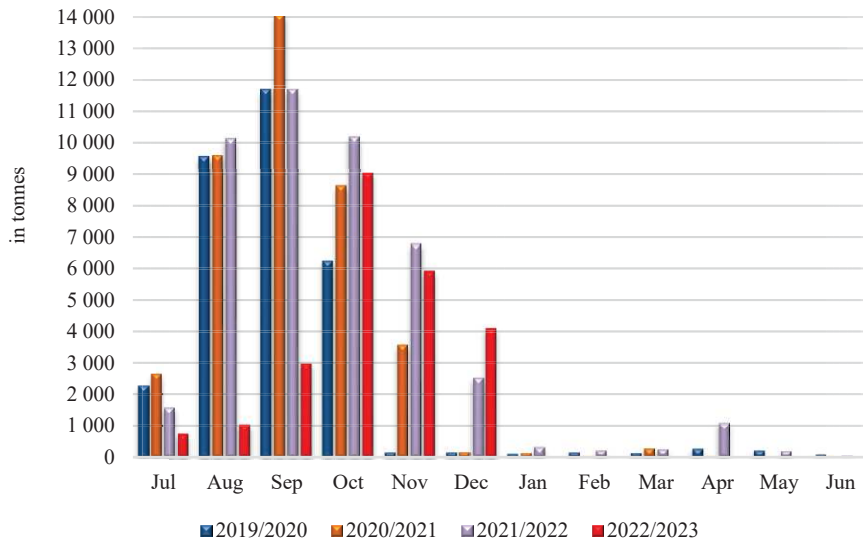


Fig. 7. Imports rapeseed oil through Poland from Ukraine (in tons)  
 Source: Authors' own study based on European Commission data.

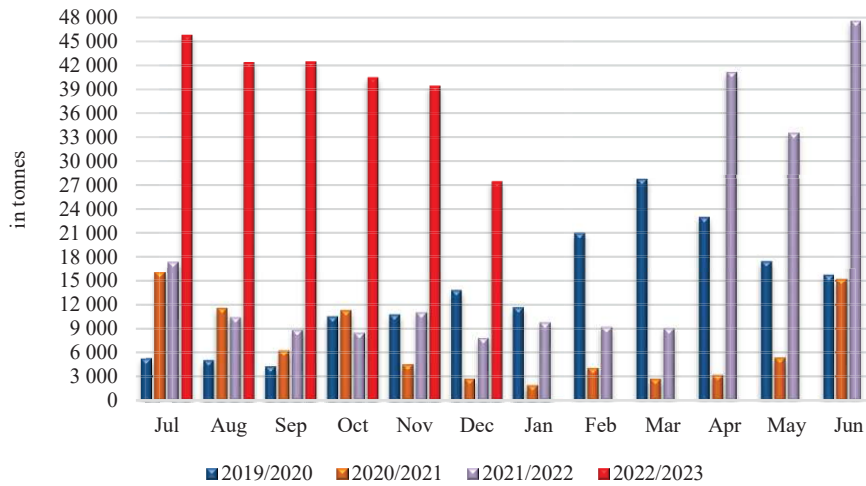


Fig. 8. Imports sunflower oil through Poland from Ukraine (in tons)  
 Source: Authors' own study based on European Commission data.

What may seem surprising is the significant increase in sunflower oil imports by Poland between July 2021 and December 2022. During this period, Poland imported almost four times more sunflower oil from Ukraine than in the corresponding months of the previous year and almost twice as much as in the same period in 2019/2020 (Figure 8). The situation changed dramatically in January 2023, when this import was over 300 times lower than the average from the previous three marketing years.

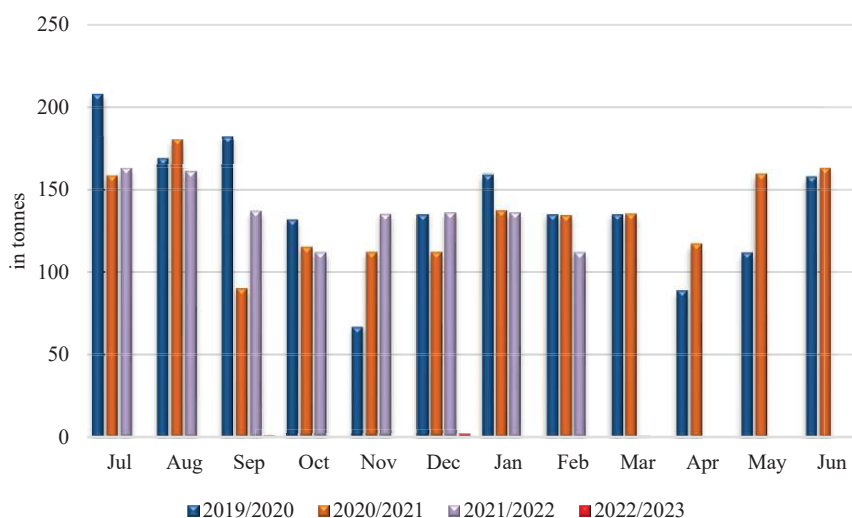


Fig. 8. Rapeseed oil exports via Poland to Ukraine (in tons)

Source: Authors' own study based on European Commission data.

Although Poland imports rapeseed oil from Ukraine, it also exports rapeseed oil to Ukraine. The marketing years 2019/2020-2020/2021 fluctuated around 1,600 - 1,700 tons. Since March 2022, this export has fallen to zero.

## Conclusions

As the data analysis indicates, palm oil production has had the most significant importance in the global production of edible oils in recent years. In the marketing years 2021/22, it reached the level of 77.64 million tons and was thus 17.54 million tons higher than in the case of soybean oil, which ranked second in the world ranking of vegetable oil production. Rapeseed oil production ranked third.

The current crude rapeseed oil production scale ranks Poland third in the European Union and sixth in the world (the country's share in EU rapeseed oil production is about 13%). As suggested by the above data, despite the dynamic development of rapeseed production and processing, Poland has low self-sufficiency in producing vegetable oils (approx. 57-64%). It, therefore, remains a permanent, sizeable net importer of them. In 2015-2022, the Polish export of vegetable oils was characterized by significant variability in

individual years. This export mainly concerned rapeseed oil. The situation related to the import of vegetable oils was different, with an upward trend visible in the years 2015-2022. The analysis showed that from the 2019/2020 marketing year, the import of edible oils to the EU and Poland from Ukraine had been gradually increasing. This trend was disrupted by the outbreak of war in Ukraine, which caused a decrease in the production of oilseeds and, consequently, a decline in exports. Therefore, in recent months, Poland and the EU have seen a noticeable decline in imports of vegetable oils from Ukraine. It is estimated that in the coming months, the level of imports of rapeseed oil to Poland and the EU from Ukraine will continue to decrease. It should be mentioned that the war in Ukraine and the resulting decline in agricultural production in this area may deepen this phenomenon. Consequently, this may translate into a decrease in rapeseed and sunflower oil inventories in European countries and, consequently, an increase in prices. Given the recent shocks in the agricultural products market (COVID-19, war in Ukraine, drought, embargo on grain exports from Russia, rising inflation), a problematic situation on the food market can be expected soon (Franc-Dąbrowska and Drejerska 2022) which may be particularly visible in the case of products where Ukraine is an essential player on the international arena.

It should be noted that the Ukrainian market also plays a vital role in the import of three main vegetable edible oils through Poland. According to the data of the European Commission, in the last five years, on average, almost 90% of the three oils imported by Poland (sunflower oil, rapeseed oil, soybean oil) came from Ukraine. Therefore, it is not difficult to conclude that the disruption in the production and, thus, the export of Ukrainian edible oils has a significant impact on the Polish market. It should be noted that this situation may deepen in the coming months due to the fact that domestic agricultural producers are struggling with difficulties related to the increase in production costs, which in turn may translate into an increase in the prices of raw materials for the production of edible vegetable oils.

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