

AGRICULTURAL PRODUCTION IN UKRAINE: AN INSIGHT INTO THE IMPACT OF THE RUSSO-UKRAINIAN WAR ON LOCAL, REGIONAL AND GLOBAL FOOD SECURITY

Jaime A. Teixeira da Silva^{1*}, Inna Koblianska² and Anatolii Kucher^{3,4}

¹Independent researcher, Ikenobe 3011-2, Kagawa-ken, 761-0799, Japan

²Department of Economics and Entrepreneurship named after Professor I.M.
Briukhovetsky, Sumy National Agrarian University,
160 H. Kondratiev St., 40021, Sumy, Ukraine

³Department of Management and Organizations, Lviv Polytechnic National
University, 5 Metropolyta Andreia St., 79007, Lviv, Ukraine

⁴Department of Innovative Economics, External Relations and Informatization of
Scientific Research, NSC "Institute for Soil Science and Agrochemistry Research
named after O.N. Sokolovsky", 4 Chaikivska St., 61024, Kharkiv, Ukraine

Abstract: The ongoing Russo-Ukrainian war is affecting Ukrainian agriculture. For example, Ukraine is no longer able to export agricultural products such as grains and cereals by sea to regional (European) and international markets, although this has been partially mitigated by the creation of a "grain corridor". As a result, food security in Ukraine, and to some extent, in the region (EU) and globally, is at some risk, especially in countries that rely heavily on agricultural imports from Ukraine. About 70% of the land in Ukraine is used for agricultural production. This paper provides an overview of Ukrainian agricultural production using statistics for 2018–2022, based on available literature, as well as FAO and official Ukrainian government statistics. Global production of the main grain crops and cereals (wheat, maize, barley, rapeseed, and sunflower), ranging between 2.9 and 6.6%, showed an upward trend in 2017–2021. Ukraine accounted for 9, 12, 12, 14, and 50% of the global trade market (import + export) in 2020/2021 for wheat, maize, barley, rapeseed, and sunflower oil, respectively. About 75% of agricultural products and services (892,852 million UAH in total) come from the crop industry, with the remainder from the livestock industry. Fertilizer export was banned in 2022.

Key words: agricultural production, economic reform, fertilizer, grains, pre-war and post-war restoration, wheat.

*Corresponding author: e-mail: jaimetex@yahoo.com

Introduction

Even though an armed conflict has existed between Ukraine and the Russian Federation since at least 2014, following Euromaidan and the annexation of Crimea by the Russian Federation, as well as the break-away movements in the Donbas region (parts of Luhansk and Donetsk oblasts), this conflict developed into a full-blown war starting with the invasion of Ukraine by the Russian Federation on 24 February 2022.

Although many aspects of society and the economy have already been affected (Astrov et al., 2022; Liadze et al., 2022), the aim of this paper is to focus on how agriculture in Ukraine may be impacted by the war.

Spring is traditionally the start of the grain sowing season in Ukraine and in much of central and southern Europe, and this generally implies sowing in March and April, precisely when Ukraine was invaded, with the bombing of infrastructure and agricultural land in several oblasts. Ukraine's agricultural products, according to the UN Food and Agriculture Organization (FAO), in terms of production and export volumes, are mainly grain crops and cereals, including wheat (*Triticum aestivum* L.), maize (*Zea mays* L.), barley (*Hordeum vulgare* L.) and rapeseed (*Brassica napus* L.), as well as sunflower (*Helianthus annuus* L.), although meat products are also an important export commodity (FAO, 2021, 2022). Agriculture, an important pillar of the Ukrainian economy, accounted for 11% of gross domestic product (GDP) in 2018–2020 (Kravchenko et al., 2020; Onegina et al., 2020) and, according to the State Statistics Service of Ukraine (SSSU), 17% of GDP in the third quarter of 2021 (SSSU, 2021a, 2022c). About 69% of land in Ukraine is used for agricultural production (SSSU, 2021a).

This paper has three objectives. First, it provides an overview of the key production and export values for some of Ukraine's main agricultural products, relying primarily on data from the FAO and the SSSU Statistical Yearbook. Second, this paper outlines developments in Ukrainian agricultural production and reform. Third, it provides a broad overview of some of the economic and structural aspects associated with Ukrainian agriculture that might be impacted by the war.

The study involved a complex of methods related to economic research, in particular: (i) the tendencies and current state of development of Ukrainian agriculture and export of agricultural products during the ongoing Russo-Ukrainian war, which was estimated by means of economic analysis and synthesis; (ii) statistical and balance methods were used to analyse the export of agricultural products; (iii) statistical groupings were used to assess the concentrations of crop production (by harvested area size under grain and leguminous crops) and livestock production (by number of farm animals) in agricultural enterprises of Ukraine; (iv) theoretical generalisation and comparison, induction and deduction were used to reveal the main areas of influence of the Russo-Ukrainian war on Ukrainian agriculture and possible impacts on national, regional and global food security, drawing conclusions.

Recent key agricultural economic indicators for Ukraine

Agricultural production patterns

According to the FAO, in 2020, Ukraine ranked seventh globally in terms of wheat production (China and India ranked first and second), producing 24.9 million tons (Mt), accounting for approximately 3.3% of global output in 2020 (FAO, 2020). Although there are no values for 2020, the FAO indicates that Ukraine ranked first in 2019 in terms of sunflower oil production (5.84 Mt) (FAO, 2019). In 2021, the greatest area of cultivated land was under cereals and leguminous crops (SSSU, 2022a).

Regarding Ukraine's role in global food production (Figure 1), we note its relative share in the output of main products. In 2021, during the pre-war period (Figure 1), Ukraine accounted for 2.9% of cereals, 4.1% of wheat, 3.3% of coarse grain (including sorghum, millet, rye, oats and other grains), 3.2% of maize, 6.6% of barley, and 3.7% of oil crops in terms of global relative production values. Ukraine's share in global production of these crops showed an upward trend in 2017–2021. The share of livestock products was not so large (Figure 1), accounting for only 0.7% of meat production (compared to global values in 2020 and 2021) and for 1.1, 1.0, and 0.9% of global milk production in 2017–2019, 2020, and 2021, respectively.

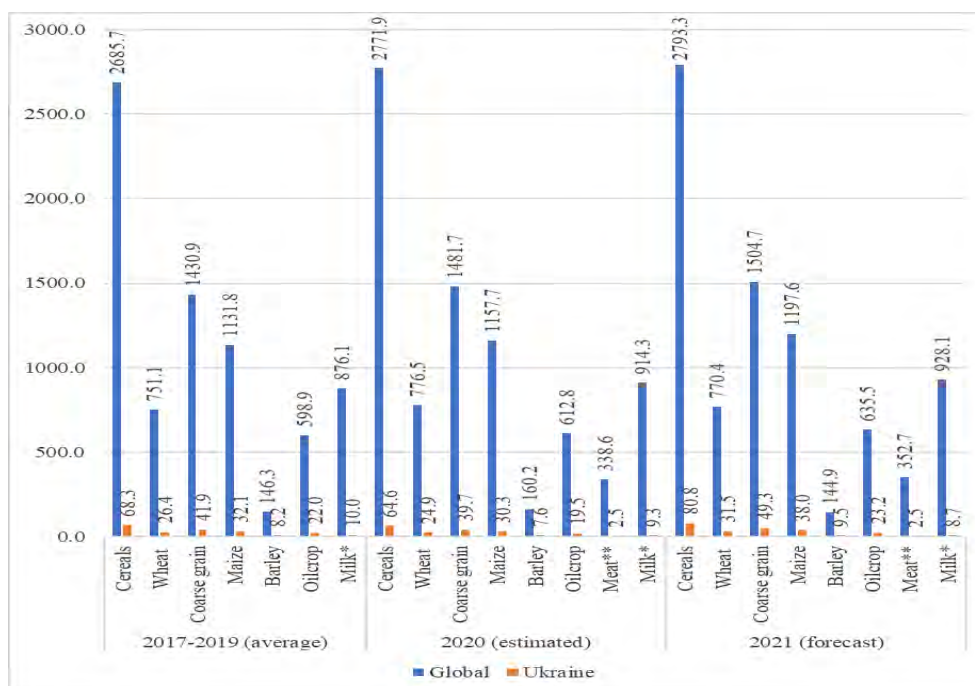
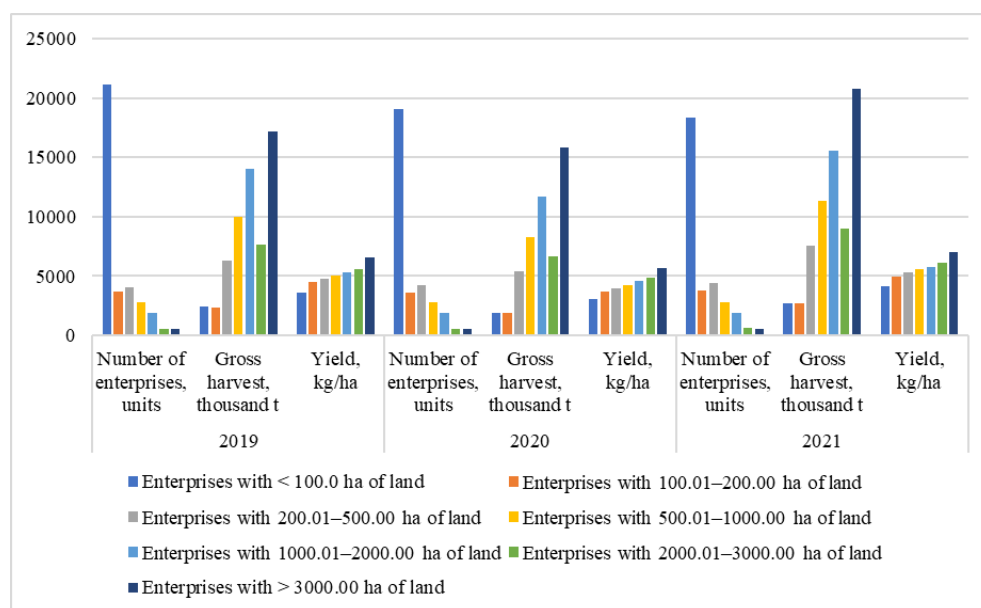


Figure 1. Agricultural production in Ukraine and globally, Mt. Source: FAO (2021).

Agriculture in Ukraine has a bipolar structure with large volumes produced by agricultural enterprises intended for export purposes, as well as multiple smaller enterprises and semi-subsistence households that produce potatoes, vegetables, fruits and berries that satisfy domestic food demand and ensure national food security (Mishenin et al., 2021; Koblianska et al., 2020). In particular, grain production in Ukraine is characterised by a high concentration of land and harvesting volumes in large enterprises, as shown by the grouping results (Figure 2).



Sources: SSSU, 2020, 2021a, 2022a; authors' compilation and visualisation.

Figure 2. Groupings of enterprises by the size of harvested area under grain and leguminous crops in Ukraine.

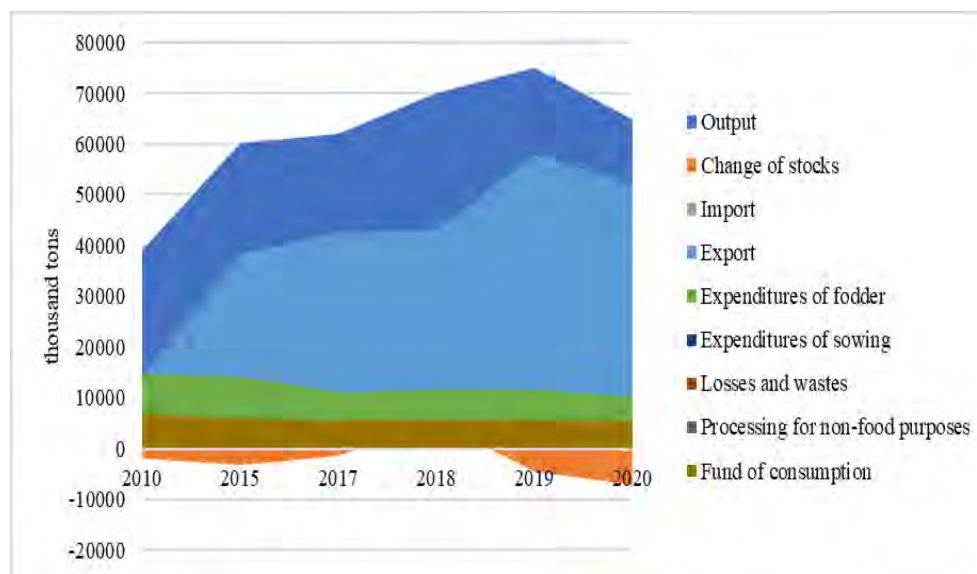
SSSU data indicates that in 2019–2021, more than 500 enterprises grew grain on an area of more than 3000 ha and produced about a third of the gross grain harvest in Ukraine. These enterprises have the highest level of intensification of grain production, which is reflected in the highest yields (for example, in 2021 it was 7.04 t ha^{-1} , which is 18.7% more than the average for Ukraine). Many of these enterprises are part of large agro-industrial formations, or agricultural holdings, which cultivate significant areas of agricultural land (SSSU, 2020, 2021a). For example, in 2021, the 10 largest agricultural holdings of Ukraine, in terms of agricultural land, cultivated 2.65 million ha, and the largest agricultural enterprise was Kernel, which cultivated 510,000 ha of agricultural land (IAMO, 2021).

Enterprises also operate in the livestock industry, and more than half of the livestock in the corporate sector is concentrated in large enterprises. Data as of 1 January 2022 indicates that 278 enterprises kept more than 1000 head of cattle (58.2% of the total), 71 enterprises kept more than 10,000 head of pigs (66.5% of the total), 75 enterprises kept more than 500 head of sheep and goats (69.5% of the total), and 33 enterprises kept more than 500,000 head of poultry (81.5% of the total) (SSSU, 2022b).

In summary, Ukraine's agriculture, primarily crop production and to a lesser extent animal production, is thus a core economic revenue generator and source of food security for Ukraine and the world (Kravchenko et al., 2020; FAO, 2022).

Ukraine in the global food trade arena

In the value structure of exports of agricultural products and provisions from Ukraine, the share of grain in 2020 accounted for 42.4%, which is 17.5% more than in 2010 (SSSU, 2021a). An analysis of the balance shows that: 1) over the past 10 years, grain production has tended to increase (from 39.3 Mt in 2010 to 64.9 Mt in 2020), as have exports (from 14.2 Mt in 2010 to 52.2 Mt in 2020); 2) Ukraine has exported three-quarters of its production; 3) domestic grain consumption accounts for only 20–25% of total production (Figure 3).

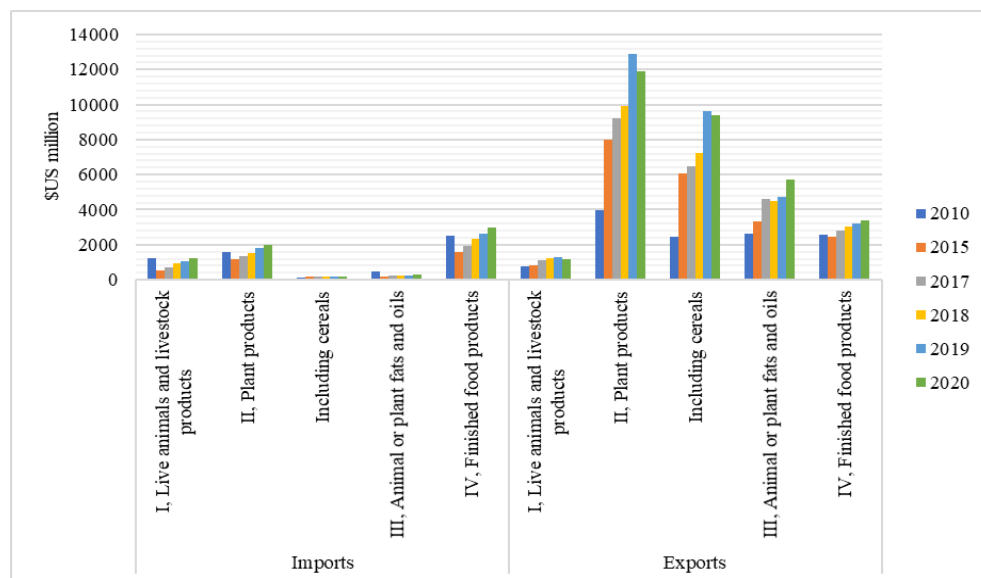


Source: SSSU (2021a); authors' calculations.

Figure 3. The balance of grain and leguminous crops (including products of grain processing counted as grain) in Ukraine.

Ukraine is one of the world's five largest grain exporters. In 2021, Ukraine was among the top five largest exporters of the following grains and their processed products (ranked first to fifth): millet, maize, barley, fresh and chilled peas, dried peas, and wheat (Dukhnytskyi, 2022). This suggests that, in terms of grain-based food security, Ukraine fed three times more people than its own population. When Ukraine was invaded by the Russian Federation in February 2022, over 400 million people around the world depended on grain supplies from Ukraine (Leshchenko, 2022a; United Nations, 2022).

The total amount of foreign exchange earnings from grain exports amounted to \$US9.4 billion in 2020, which is 3.8-fold more than in 2010 (Figure 4). Revenues from agricultural exports play a key role in shaping Ukraine's foreign exchange earnings. For example, in 2021, according to the Minister of Agrarian Policy and Food of Ukraine, agriculture provided Ukraine with more than 41% of foreign exchange earnings (Leshchenko, 2022a).



Source: SSSU (2021a); authors' calculations.

Figure 4. Commodity patterns of imports and exports of agricultural products and provisions in Ukraine.

It is significant that, despite substantial grain exports, Ukraine also imports grain (Figure 4). However, the volume of these imports is insignificant since their share in the structure of total agricultural imports accounts for only 2.5–4.4% (authors' calculation based on data from Figure 4). The trend towards an increase in the volume of raw materials with an almost unchanged volume of exports of

finished food products remains negative for the Ukrainian economy. At the same time, imports of processed finished food products dominate the structure of imports of agricultural products, accounting for 43.5–45.7% (SSSU, 2021a). In the context of blocking grain exports, one option is to diversify the economy through internal processing of raw materials into finished food products.

In 2021, supplies of domestic agricultural products to the European Union (EU) amounted to US\$8.4 billion, a 25% increase over the previous year (US\$6.7 billion). This increase is partly due to an increase in the value of most categories of goods on the world market, and partly due to an increase in shipments (Pugachov, 2022). According to scientists from the National Scientific Centre “Institute of Agrarian Economics”, the commodity structure of agricultural exports to the EU largely corresponds to the general structure of agricultural exports from Ukraine (Pugachov, 2022). More than 80% of these accounted for by exports of oils and fats, cereals and oilseeds, as well as residues from the processing industry. In 2021, all these product groups showed growth in value terms, having a decisive impact on increasing Ukrainian total agricultural exports to the EU. For several years in a row, the EU has been the main market for a number of different agri-food products from Ukraine, among which the following should be noted (the percentage of foreign sales of these types of agricultural products is provided in parentheses): fish and fish products – US\$36 million (62%); egg products – US\$7 million (58%); honey – US\$128 million (89%); live plants and seedlings – US\$5 million (63%); fruits and berries – US\$315 million (86%); rapeseed – US\$1303 million (77%); soybean oil – US\$227 million (77%); and rapeseed oil – US\$174 million (78%) (Pugachov, 2022).

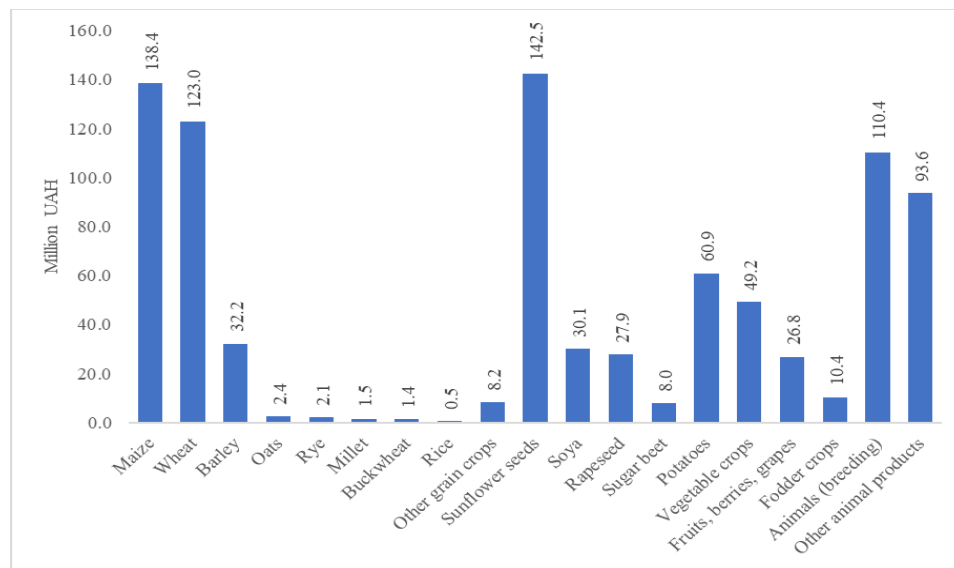
In summary, Ukraine accounted for 9, 12, 12, 14, and 50% of the 2020/2021 global trade market (import + export) for wheat, maize, barley, rapeseed, and sunflower oil, respectively (FAO, 2021).

Revenues, costs, and other notable issues

The 2021 FAO report indicates a few facts of possible relevance that are worth mentioning: 1) the Russian Federation banned the import of barley from Ukraine starting in July 2021; 2) Ukraine banned the import of sunflower oil from the Russian Federation in April 2021; 3) Ukraine set an export upper limit of 25.3 Mt of wheat for 2021/2022; 4) global freight rates (year-on-year, 26 October 2021), including heavy grains, increased between 103 and 181%, depending on the route (FAO, 2021).

In 2020, the biggest income revenue was from grain crops (309,737 million UAH), followed by industrial crops (in total). Wheat, maize and sunflower seeds were the greatest revenue generators (Figure 5). Even though the livestock industry also generated significant revenue, the crop industry, which accounts for about 75.1% of all agricultural products and services (892,852 million UAH in total) (SSSU, 2021b), is the main income source.

Total costs for all agricultural production were 441,529 million UAH, of which 13.7% went for inorganic fertilisers, 8.1% for seeds and planting materials, 7.0% for oil products, 4.8% for repair and spare parts, and 6.8% for labour (SSSU, 2021a). A total of 17.4 million ha of land employed organic or inorganic fertilisers in 2020, mainly nitrogen, phosphate and potash fertilisers, accounting for 68%, 17%, and 14% of inorganic fertiliser use, respectively (SSSU, 2021a).

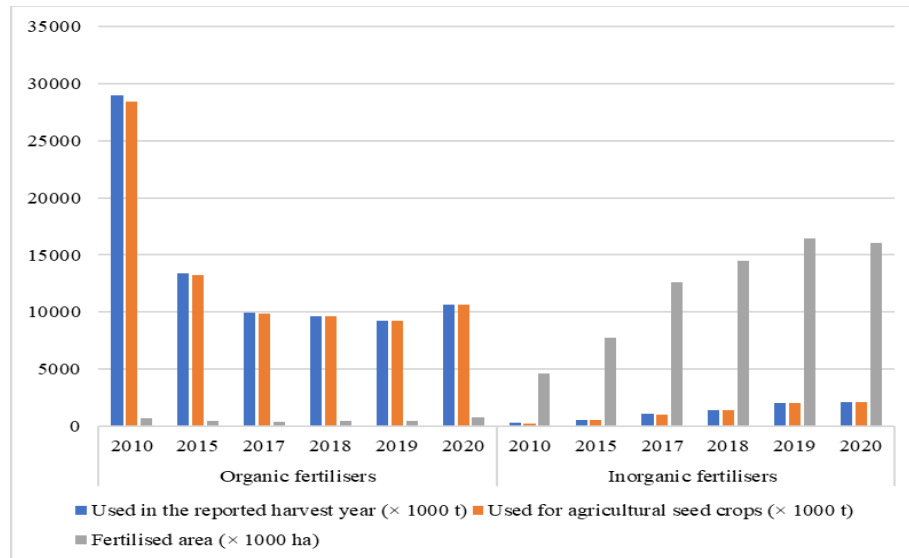


Source: SSSU (2021b); authors' calculations.

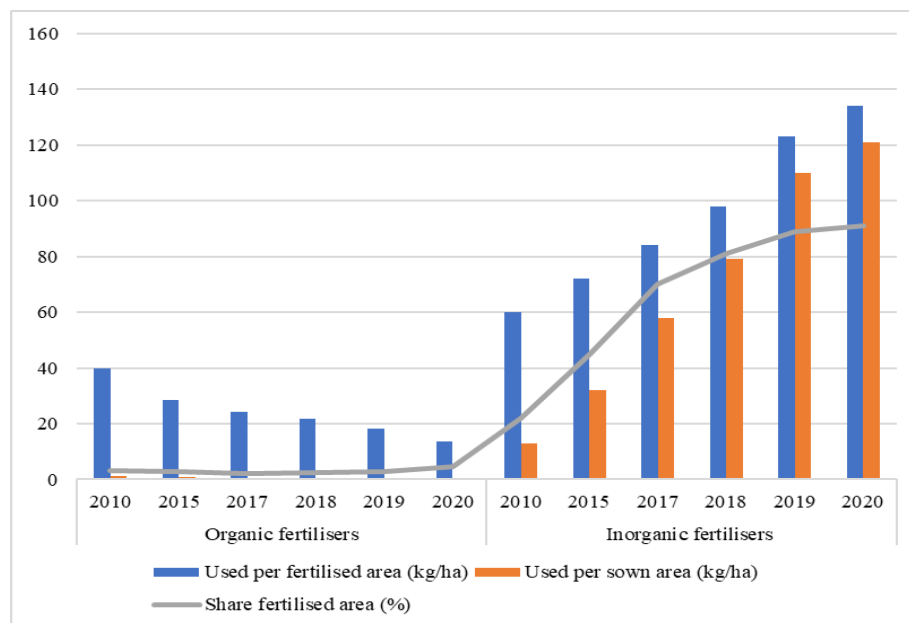
Figure 5. The income revenue of the main agricultural output in Ukraine in 2020.

Fertilisers

An analysis of the dynamics of the use of mineral fertilisers in Ukraine shows a clear trend towards an increase in the amount of inorganic fertilisers applied (Figure 6a) and the intensity of their application per unit area of land (Figure 6b). This had a positive impact on crop yields, ensuring the balance of nutrients in the soil (Mishenin et al., 2017; Ulko et al., 2022). However, this war will lead to a significant reduction in the amount of fertiliser application, which is associated with both their physical shortage and an increase in prices, and thus a high risk of not harvesting, due to hostilities. This aggravates the problem of an insufficient amount of fertilisers being applied in Ukraine (Strochenko and Koblianska, 2016; Strochenko et al., 2017; Kosovych et al., 2022), thereby threatening future yields. For example, the amount of nitrogen fertilisers applied to soils in Ukraine is 1.7-fold less than in the EU while the amount of applied organic fertilizers is 10.1-fold less (Moklyachuk et al., 2019).



a) Application of fertilisers



b) Intensity of fertiliser use

Source: SSSU (2021a); authors' compilation.

Figure 6. The use of inorganic and organic fertilisers for the harvest of agricultural crops in agrarian enterprises of Ukraine.

As a consequence of the state of war, in order to maintain balance in the domestic market of mineral fertilisers, on 12 March 2022, the Ukrainian Government introduced a zero quota for their export, i.e., a de facto ban on the export of fertilisers from Ukraine (Leshchenko, 2022b). This applies to nitrogen, phosphorus, potassium and complex fertilisers. According to experts from the GMK Center, almost 45% of Ukrainian nitrogen fertiliser exports went to the EU in 2021 (Glushchenko, 2022). The biggest importers of Ukrainian nitrogen fertilisers were (in thousand t) Romania (190), Italy (138), France (104), Hungary (88), Spain (56), Bulgaria (50), and Poland (40). Consequently, EU countries will have to access and purchase nitrogen fertilisers from other countries (Glushchenko, 2022). Even though Ukrainian producers could fully meet the capacity needs of the domestic market of nitrogen fertilisers, most of the capacities for the production of these fertilisers have been closed both due to the danger of hostilities and problems with raw material supplies. On 21 March 2022, the Russian Federation fired at PJSC “Sumykhimprom”, which led to an ammonia leak. According to estimates by experts from the State Ecological Inspectorate in the Sumy region, the estimated amount of damage caused to the environment due to the ammonia leak amounted to about 5.1 million UAH (State Environmental Inspectorate of Ukraine in the Sumy oblast, 2022). The Russian Federation also fired on the “Severodonetsk Azot association” (15.3% of nitrogen fertiliser production facilities in Ukraine) on 5 June 2022. It is currently closed. The “Odessa port plant” (14.4% of nitrogen fertiliser capacity) was shut down at the beginning of the war. “Rivneazot” is located in a potentially dangerous zone where rocket attacks are possible (Glushchenko, 2022).

At the same time, the production of complex fertilisers is underdeveloped in Ukraine. In particular, 1.9 Mt of complex fertilisers were imported into Ukraine in 2021 and almost a third of these fertilisers were previously imported by Ukraine from Belarus, so now there is an urgent need to replace this import volume (Glushchenko, 2022). A possible substitution could be the development of Ukrainian deposits, in particular the development of the Izyske deposit and the use of milled phosphorites in agriculture, but this part of the Ukrainian territory (i.e., Izyum district, Kharkiv oblast) is in a volatile location. Therefore, alternative fertiliser systems should be used, including green manure (Hetmanenko et al., 2021; Mishenin et al., 2022). Rising costs of organic fertilisers by about 30% (Liadze et al., 2022) have already caused rises in the costs of agricultural commodities (Shahini et al., 2022).

The state of Ukrainian agriculture during the war: a macro context

Although statistics indicate the successful development of Ukrainian agriculture and its growing role as a “food basket” globally (Mishenin et al., 2021),

it is necessary to understand several aspects of the context in which Ukrainian agriculture is operating during this war.

Ukrainian crop production is developing its own trajectory, and not following the development path of Germany or the USA. After a rather long recession, due to imported technologies and production components, the agricultural sector embarked on a path of stable growth with an annual increase in wheat yields of around 0.1 t ha⁻¹, and further development of crop production in Ukraine is likely to choose an intensive development path (Voronenko et al., 2020; Mishenin et al., 2021). However, this requires an increased use of organic and mineral fertilisers, taking into account the need for environmentally-friendly agriculture (Kosovych et al., 2022; Mishenin et al., 2022; Ulko et al., 2022). GMK experts also expect an increase in the use of fertilisers due to the introduction of a land market (Glushchenko, 2022). Grain production has always been Ukraine's most important agricultural sector, providing national food independence and security, with wheat, maize and barley being the most important cereal crops, followed by buckwheat (*Fagopyrum esculentum* Moench), millet, and rice (*Oryza sativa* L.) (Averchev and Fesenko, 2019; Mishenin et al., 2021). In 2018, the total production of buckwheat, millet and rice was 137, 81 and 69 thousand t, respectively. Zhytomyr ranked first in 2018, in terms of harvested area and yield of buckwheat, Kharkiv produced the highest yield of millet (with several oblasts having similar harvested areas, around 6000–6300 ha each), while rice cultivation was almost exclusive to the Kherson and Odessa regions along the Black Sea coast, with 7700 and 4900 ha of harvested area and production of 44,500 and 24,700 t, respectively (Averchev and Fesenko, 2019). As these are active war zones, and since Russia has annexed Kherson (Reuters, 2022a), rice will be a highly contested cereal.

Bazaluk et al. (2021) noted that the production of grain and leguminous crops amounted to 75.1 Mt in 2019, of which 38% was in the Dnieper basin (encompassing Cherkasy, Dnipropetrovsk, Kyiv, Kherson, Mykolaiv, Poltava, and Zaporizhzhia regions), while 15.3 Mt of sunflower seeds were produced in the same year, of which 41.5% originated from the Dnieper basin. The Kherson and Zaporizhzhia regions are active war zones. Bazaluk et al. (2021) have also indicated that 40% of grain is transported by rail, 24.4% by road, and about 0.5% by inland waterways, with road transport being the least energy efficient, which has implications for the transport not only of grain, but of all agricultural products, nationally and regionally, given the current fuel and energy crisis. At the beginning of the war, the Ukrainian military closed all sea ports (Reuters, 2022b), while civil and commercial airspace was also closed (Reuters, 2022c), leaving rail and road as the only currently available options to transport grain and other agricultural products. Given that the entire coast of the Azov Sea, which is directly connected to the Black Sea, is under the control of the Russian Federation, and transport to the east through Russia or to the north through Belarus is evidently not an option,

this leaves only limited options to export agricultural products out of Ukraine, via Moldova, Romania, Hungary, Slovakia, or Poland, all of which are located on the western border of Ukraine. Regional (Mediterranean) importers of Ukrainian wheat, barley and maize, namely Italy, Turkey, Egypt, Cyprus, and Lebanon, will all be impacted since the ports of departure are all on the Azov Sea (Reuters, 2022b). Even though (data as of 1 February 2022) there are about 26.3 Mt of grain available (Reuters, 2022b; Rozhko, 2022), their distribution will be challenging, given that Dnipropetrovsk, Donetsk, Kherson, Kharkiv, Luhansk, Mikolayiv, Odessa, and Zaporizhzhia areas, which are under occupation or zones of active military conflict, are some of the main production centres for these crops.

Electric power and fuel costs accounted for only 1.0% and 0.4%, respectively of total agricultural production costs in 2020 (SSSU, 2021a). It will therefore be interesting to see how the relative weighting of these two factors on costs will change for the current agricultural year.

Future challenges

Deppermann et al. (2018) used models to estimate a 64% cumulative (Russia and Ukraine) increase in wheat, barley and maize yield by 2030, or 4% of global production. However, they only took into account the use of abandoned land and the application of a high-input system (presumably higher inorganic fertiliser use), but they did not consider geopolitical instability, war, or any of the limitations that both Ukraine and Russia are now experiencing as a direct result of this war. Curiously, Skrypnyk et al. (2021) noted, as a result of climate change, an increase in maize production in 2000–2018, particularly in the steppe zone, which is due to the resilience of this crop to a wider range of agro-climatic zones.

The total volume of grain and flour exports from Ukraine in the 2021/2022 market year decreased by 17.7% compared to the 2019/2020 market year, including the volume of flour exports, which decreased almost five-fold (Table 1). Although these data are the latest, they do not, of course, give a full picture of the scale of losses to be expected as a result of this war.

According to the forecast of Voronenko et al. (2020), the food security index of Ukraine is in a satisfactory state and shows a slight upward trend in the period 2020–2022, but the risks of a decline in the integral index are beyond satisfactory. This forecast of food security could be accurate if the state of the economy were to remain unchanged.

Plans to expand organic agriculture, which currently accounts for only 1.1% of all agriculture in Ukraine, as a sustainable development goal (Fedchyshyn, 2020), and to strengthen the competitive position in the EU market (Ostapenko et al., 2020), are now delayed due to the occupation of all major regions related to organic agriculture (OrganicInfo, 2022). Moreover, weak internal demand, which

previously was one of the greatest obstacles inhibiting the development of organic agriculture in Ukraine (Artysh, 2018), will continue to impede further growth of this sector due to economic problems caused by the war. Provided that 40% of agricultural crop production in Ukraine uses green manure (organic fertiliser), it might be possible to use as much as 30% of the biological yield of field crop biomass for diesel biofuel (bioethanol) production (Golub et al., 2021). Such use of agricultural waste needs to be part of an integrated national resource recycling programme (Shubalyi et al., 2020; Kosovych et al., 2022; Mishenin et al., 2022). Considering the energy-dependence of Ukraine, manure-based biogas production could, with suitable technology, meet 3.2% and 2.3% of Ukraine's total electricity and natural gas demands, respectively (Was et al., 2020).

Table 1. Export of cereals, legumes (with processed products) and flour in the 2021/2022 market year, thousand t*.

Indicators	2019/2020 market year	2020/2021 market year	2021/2022 market year	2021/2022 in % relative to 2019/2020
Cereals and legumes, total	56627	42485	47177	83.3
Including:				
wheat	20522	16030	18578	90.5
barley	5076	4146	5686	112.0
rye	8.2	7.0	161.6	1970.7
maize	30330	21610	22445	74.0
Wheat flour	331.7	111.0	69.8	21.0
Other flour	2.5	1.1	1.6	64.0
Total flour	334.2	112.1	71.4	21.4
Total export (grain + flour)	57173	42634	47273	82.7

*Values as of 6 June 2022. Sources: SSSU (2021a); State Customs Service of Ukraine (2022).

A case study that assessed 516 enterprises in the Kharkiv oblast identified integrated animal husbandry as an effective means to intensify sustainable agriculture (Strapchuk and Mykolenko, 2021). In 2015–2017, the meat and milk security status in Ukraine was similar to that in the EU, and lower for several fruits and berries. Regional (oblast) consumption ability depends on per capita annual income, which, in 2017, was the highest in Kyiv (US\$ 3064), followed by Dnipropetrovsk (US\$ 2038), and the lowest in Donetsk (US\$ 938) and Luhansk (US\$ 619) (Vasylieva, 2019), the latter two oblasts being in the war zone. Even though several aspects of Ukrainian agricultural land use are superior to those of EU member states, many are not, so Ukrainian agriculture has the potential to be optimised for increasing yield (Petrychenko et al., 2018). Romanchuk et al. (2021), relying on SSSU data, indicated an increase in inorganic fertilisers (in kg ha⁻¹) from 79 and 96 in 2015 and 2016, respectively, to 121 and 119 in 2018 and 2019, respectively, noting that drinking water in 10 out of 15 oblasts had nitrate levels posing a high health risk to children and/or adults, as assessed by EU directives.

In Ukraine, labour productivity, and foreign investment, either economically or in the form of labour, are impacted by security and political stability (Onegina et al., 2020; Onegina and Vitkovskyi, 2020). To meet EU standards, several factors need to be considered (investments, fixed assets value, consumer price index, number of employees in the industry, quantity of goods and services sold) to ensure agricultural GDP growth (Sonko et al., 2018). Provided the war continues, or vast tracts of agricultural land are under military occupation, these areas are unlikely to attract either labour or investment. Moreover, with large numbers (about 8.0 million people) of internally displaced people (Ministry for the Reintegration of the Temporarily Occupied Territories, 2022), the equally large numbers of emigrants (about 3.5 million people) fleeing the war (Drannik, 2022), and the general mobilisation of men to fight on front lines, may have the potential to reduce labour potential if such individuals are in any ways connected to the agricultural sector.

Since 2014, the EU has opened its markets to Ukrainian agricultural products, stimulating agricultural output (e.g., for crops, 750,100 UAH income in 2016 versus 954,400 UAH in 2019) and labour productivity, but the most productive oblasts were generally concentrated in the west of Ukraine (Shmatkovska et al., 2020). In 2017, 86.9% of agricultural land owners possessed less than 1000 ha while 14 agroholdings held 3.42 million ha of land (Shvorak et al., 2020), suggesting that the agricultural land market needs to be better managed for efficient long-term development (Mohylnyi et al., 2022). The resource potential of low-income family farms, particularly family agricultural businesses, also needs reform to maximise productivity and to optimise economic activity (Strochenko et al., 2017; Zbarsky et al., 2020; Koblianska et al., 2020). Such a management programme would need to consider the weighted benefits of multiple social, economic and environmental factors (Sokil et al., 2018; Mishenin et al., 2021). Long-term socio-economic and political turmoil, and the lack of relative peace and security are not conducive to establishing a sustainable agricultural model in Ukraine (Kolesnyk et al., 2018). Without political and economic stability, consumer confidence will not be able to increase, and thus Ukraine will struggle to meet EU agricultural standards to be competitive in the market (Rogach et al., 2019).

Finally, a growth in debt burden or external creditors, reduced foreign investment, and decreasing per capita capital investment following the war might all contribute to unstable food security in Ukraine. Decreased investment will further move Ukraine from its ability to satisfy two UN Sustainable Development Goals (Plastun et al., 2021). The Ukrainian state funds only cover a third of the losses associated with natural calamities, independent of the level of agricultural insurance, i.e., low compensation efficiency. Thus, the continuation of Ukraine's agricultural insurance market reform – initiated by a special law in July 2021 (Verkhovna Rada of Ukraine, 2021) – is needed for farmers to appreciate the benefits of inclusion, as only 2% (661,000 ha) of all agricultural land in Ukraine was insured in 2017

(Agricultural Insurance Market, 2018; Prokopchuk et al., 2019).

Finally, this war has already had significant negative consequences for food security on a global scale (Ben Hassen and El Bilali, 2022).

Conclusion

The Russo-Ukrainian war, which has been ongoing since 2014, and amplified by the invasion of Ukraine on 24 February 2022, has caused not only a physical disruption of the planting season, destruction of agricultural land due to artillery strikes and bombardments, but also a considerable negative impact on distribution routes, mainly sea ports in the Azov Sea and the Black Sea, but also on land routes, via roads and railways, due to destroyed or unsafe roads and rail hubs. This affected the transport of current agricultural products in stock, such as cereal grains, although a 'grain corridor' was brokered by the UN at the end of July, 2022. These impacts are exacerbated by fuel and energy crises, and a rise of fertiliser costs.

The assessment of these consequences, in particular, a determination of the extent of the damage caused, and the substantiation of directions for solving the problem of guaranteeing food security at the national, regional and global levels, will require much scientific attention in the coming years.

Given the adverse social, economic, and political effects of this war that some countries are experiencing now, the long-lasting negative consequences of this war on global security are evident. Estimates of appropriate global food system losses and transformations, social and economic causes-and-effects, and suggestions on how to deal with them should be at the forefront of the global research agenda.

Acknowledgements

The authors thank Prof. Dr. Viktoriya Onegina (State Biotechnological University, Kharkiv, Ukraine) for broad suggestions and comments on an early version of the paper.

References

- Agricultural Insurance Market (2018). Agricultural insurance market review for 2017 and projections for 2018: Analytical report. Ministry of Agricultural Policy and Food of Ukraine, in cooperation with the project "Development of agriculture financing in Europe and Central Asia", IFC, World Bank Group. Kyiv, 2018. http://www.aau.org.ua/media/publications/529/files/Market%20Survey%20Report_2018_04_13_11_06_14_365993.pdf (April 13, 2018; last accessed: 7 June 2023) (in Ukrainian)
- Artysh, V.I. (2018). Polish experience on organic production and prospects for its development in Ukraine. Scientific bulletin of NUEL of Ukraine. Economics, *Agrarian Management and Business Series*, 284, 182-189. (in Ukrainian)

- Astrov, V., Ghodsi, M., Grieveson, R., Holzner, M., Kochnev, A., Landesmann, M., Pindyuk, O., Stehrer, R., Tverdostup, M., & Bykova, A. (2022). Russia's invasion of Ukraine: Assessment of the humanitarian, economic, and financial impact in the short and medium term. *International Economics and Economic Policy*, 19 (1), 331-381.
- Averchev, O., & Fesenko, H. (2019). Analysis of economic aspects of buckwheat, panicum and rice growing and production in Central and Eastern Europe and Ukraine. *Baltic Journal of Economic Studies*, 5 (5), 213-221.
- Bazaluk, O., Havrysh, V., & Nitsenko, V. (2021). Energy efficiency of inland waterways transport for agriculture: The Ukraine case study. *Applied Sciences*, 11 (19), 8937.
- Ben Hassen, T., & El Bilali, H. (2022). Impacts of the Russia-Ukraine war on global food security: Towards more sustainable and resilient food systems? *Foods*, 11, 2301.
- Deppermann, A., Balkovič, J., Bundle, S.-C., Di Fulvio, F., Havlik, P., Leclère, D., Lesiv, M., Prishchepov, A. V., & Schepaschenko, D. (2018). Increasing crop production in Russia and Ukraine – regional and global impacts from intensification and recultivation. *Environmental Research Letters*, 13, 025008.
- Drannik, A. (2022). "How much is life": How Ukraine will return migrants. <https://vesti.ua/uk/politika-uk/skolko-stoit-zhizn-kak-ukraina-budet-vozvrashhat-migrantov> May 19, 2022; last accessed: 17 June 2023) (in Ukrainian)
- Dukhnytskyi, B. (2022). In 2021, Ukraine maintained and strengthened most of its positions in world agri-food markets. <http://www.iae.org.ua/presscentre/archnews/3386-u-2021-rotsi-ukrayina-zbrehla-i-posylyla-bilshist-vlasnykh-pozytsiy-na-svitovykh-rynках-ahroprodovolchoyi-produktsiyi-bohdan-dukhnytskyy.html> (last accessed: 17 June 2023) (in Ukrainian)
- FAO (2019). Oil, sunflower. <https://www.fao.org/faostat/en/#data/QC> (last accessed: 17 June 2023).
- FAO (2020). Wheat. <https://www.fao.org/faostat/en/#data/QC> (last accessed: 17 June 2023).
- FAO (2021). Food Outlook - Biannual Report on Global Food Markets, 112 pp. ISBN 978-92-5-135248-9 (November, 2021).
- FAO (2022). The importance of Ukraine and the Russian Federation for global agricultural markets and the risks associated with the current conflict. Executive Summary, 47 pp. (March 25, 2022).
- Fedchyshyn, D. (2020). Theoretical bases of formation and development of agricultural organic production in Ukraine in modern economic conditions. *Economics of Agriculture*, 67 (3), 939-953.
- Glushchenko, A. (2022). Production of fertilizers in Ukraine are disrupted because of war. <https://gmcenter/en/news/production-of-fertilizers-in-ukraine-are-disrupted-because-of-war> (March 23, 2022; last accessed: 17 June 2023)
- Golub, G., Chuba, V., Tsyvenkova, N., Marus, O., & Yarosh, Y. (2021). Bioenergy potential of Ukrainian agriculture. *International Journal of Renewable Energy Research*, 11 (3), 1223-1229.
- Hetmanenko V., Skrylnyk Ie., Kucher A., Kutova A., Artemieva K. (2021). Technological, agronomical and economic efficiency of new organic and organo-mineral soil amendments. E3S Web of Conferences. Second International Conference on Sustainable Futures: Environmental, Technological, Social and Economic Matters (ICSF 2021). Vol. 280, 06004. <https://doi.org/10.1051/e3sconf/202128006004>
- IAMO (Leibniz Institute of Agricultural Development in Transition Economies) (2021). TOP 10 Ukrainian agricultural land users 2021. <https://www.largescaleagriculture.com/home/news-details/top-10-ukrainian-agricultural-land-users-2021> (October 7, 2021; last accessed: 17 June 2023).
- Koblianska, I., Pasko, O., Hordiyenko, M., & Yarova, I. (2020). Are peasant households feasible in terms of policy? The debate on the future of semi-subsistence households in Ukraine. *Eastern European Countryside*, 26 (1), 127-179.
- Kolesnyk, T., Samborska, O., Talavyria, M., & Nikolenko, L. (2018). Ensuring the sustainable development of the Ukrainian agrarian sector in conditions of globalization. *Problems and Perspectives in Management*, 16 (3), 245-258.

- Kosovych, B., Vaskivska, K., & Kucher, A. (2022). Ecologization: barriers and opportunities to overcome them in the conditions of post-war recovery. *Journal of Environmental Management and Tourism*, XIII 7 (63), 2017-2028.
- Kravchenko, O., Kucher, A., Heldak, M., Kucher, L., & Wyszulek J. (2020). Socio-economic transformations in Ukraine towards the sustainable development of agriculture. *Sustainability*, 12 (13), 5441.
- Leshchenko, R. (2022a). Share of agriculture in Ukraine's GDP exceeded 10%. <https://www.ukrinform.net/rubric-economy/3401224-share-of-agriculture-in-ukraines-gdp-exceeded-10-leshchenko.html> (February 10, 2022; last accessed: 17 June 2023).
- Leshchenko, R. (2022b). The Cabinet of Ministers imposes a ban on the export of fertilizers from Ukraine. <https://minagro.gov.ua/news/kabmin-vvudit-zaboronu-na-eksport-dobriv-z-ukrayini> (March 12, 2022; last accessed: 17 June 2023) (in Ukrainian).
- Liadze, I., Macchiarelli, C., Mortimer-Lee, P., & Juanino, P.S. (2022). The economic costs of the Russia-Ukraine conflict. *NIESR Policy Paper*, 32, 61-72.
- Ministry for Reintegration of the Temporary Occupied Territories (2022). <https://www.minre.gov.ua/news/kilkist-vnutrishno-peremishchenyh-osib-vpo-v-ukrayini-perevyschyla-8-mln-lyudey-zvidky-y-kudy> (last accessed: 17 June 2023).
- Mishenin, Y., Koblianska, I., Yarova, I., Kovalova, O., & Klochko, T. (2022). Operationalizing the sustainable fertilizer management global initiative at national level: A conceptual framework [Реалізація глобальної ініціативи з управління добривами на національному рівні: Концептуальні засади]. *Scientific Horizons*, 25 (2), 76-88.
- Mishenin, Y., Valentynov, V., Maslak, O., & Koblianska, I. (2017). Modern transformations in small-scale agricultural commodity production in Ukraine. *Marketing and Management of Innovations*, 4, 358-366.
- Mishenin, Ye., Yarova, I., & Koblianska, I. (2021). Ecologically harmonized agricultural management for global food security. In Jhariya, M. K., Meena, R. S., & Banerjee, A. (Eds.) *Ecological Intensification of Natural Resources for Sustainable Agriculture*. (pp. 29-77). Springer Nature, Singapore.
- Mohylnyi, O., Patyka, N., Kucher, A., Krupin, V., Siedlecka, A., Wysokiński, M. (2022). Features of agrarian sector deregulation in the context of martial law: shocks in food security. *Sustainability*, 14 (20), 12979.
- Moklyachuk, L., Furdychko, O., Pinchuk, V., Mokliachuk, O., & Draga, M. (2019). Nitrogen balance of crop production in Ukraine. *Journal of Environmental Management*, 246, 860-867.
- Onegina, V., & Vitkovskiy, Y. (2020). Investments and land reform in agriculture of Ukraine. *Agricultural and Resource Economics*, 6 (4), 187-210. (in Ukrainian)
- Onegina, V., Megits, N., Antoshchenkova, V., & Boblovskiy, O. (2020). Outcome of capital investment on labor productivity in agriculture sector of Ukraine. *Journal of Eastern European and Central Asian Research*, 7 (1), 12-25.
- Organic Info (2022). Statement on the situation in the Ukrainian organic sector. <https://organicinfo.ua/en/news/organic-appeal/> (March 28, 2022; last accessed: 17 June 2023)
- Ostapenko, R., Herasymenko, Y., Nitsenko, V., Koliadenko, S., Balezentis, T., & Streimikiene, D. (2020). Analysis of production and sales of organic products in Ukrainian agricultural enterprises. *Sustainability*, 12, 3416.
- Petrychenko, V.F., Korniychuk, O.V., & Voronetska, I.S. (2018). Biological farming in conditions of transformational changes in the agrarian production of Ukraine. *Agricultural Science and Practice*, 5 (2), 3-12.
- Plastun, A., Makarenko, I., Grabovska, T., Situmeang, R., & Bashlai, S. (2021). Sustainable Development Goals in agriculture and responsible investment: A comparative study of the Czech Republic and Ukraine. *Problems and Perspectives in Management*, 19 (2), 65-76.

- Prokopchuk, O., Nesterchuk, Y., Tsymbalyuk, Y., & Rolinskyi, O. (2019). Current trends in agricultural insurance market operation in Ukraine. *Problems and Perspectives in Management*, 17 (3), 57-75.
- Pugachov, M. (2022). In 2021, the volume of exports of Ukrainian agricultural products to the EU amounted to 8.4 billion USD. <http://www.iae.org.ua/presscentre/archnews/3332-u-2021-rotsi-obshyayh-eksportu-ukrayinskoyi-ahroproduktysyi-do-yes-stanovyly-84-mlrd-dol-ssha-mykola-puhachov.html> (last accessed: 17 June 2023) (in Ukrainian)
- Reuters (2022a). Pro-Moscow leaders of occupied region seek to join Russia, Zelenskiy slams 'collaborators'. <https://www.reuters.com/world/europe/pro-moscow-leaders-ukraines-occupied-kherson-seek-join-russia-tass-2022-05-11/> (May 12, 2022; last accessed: 17 June 2023).
- Reuters (2022b). Ukraine shuts ports as conflict threatens grain supplies. <https://www.reuters.com/world/europe/russia-halts-vessel-movement-azov-sea-black-sea-open-2022-02-24/> (February 25, 2022; last accessed: 17 June 2023)
- Reuters (2022c). Airlines scramble as Ukraine invasion redraws route map. <https://www.reuters.com/world/europe/airlines-should-stop-flying-over-all-ukraines-airspace-conflict-zone-monitor-2022-02-24/> (February 25, 2022; last accessed: 17 June 2023)
- Rogach, S., Vdovenko, L., & Polishchuk, O. (2019). Agriculture of Ukraine under the joint policy of the European Union. *Baltic Journal of Economic Studies*, 5 (3), 178-183.
- Romanchuk, L.D., Valerko, R.A., Herasymchuk, L.O., & Kravchuk, M.M. (2021). Assessment of the impact of organic agriculture on nitrate content in drinking water in rural settlements of Ukraine. *Ukrainian Journal of Ecology*, 11 (2), 17-26.
- Rozhko, V. (2022). Military food balances in Ukraine. Part 2. Formation of internal consumption. Cereal crops and products of their processing. APK-Inform. <https://www.apk-inform.com/uk/exclusive/topic/1526470> (April 18, 2022; last accessed: 17 June 2023)
- Shahini, E., Skuraj, E., Sallaku, F., & Shahini, S. (2022). The supply shock in organic fertilizers for agriculture caused by the effect of Russia-Ukraine war. *Scientific Horizons*, 25 (2), 97-103.
- Shmatkovska, T., Nikolaeva, A., Zabedyuk, M., Sheiko, Y., & Grudzevych, Y. (2020). Increasing the efficiency of the labour resources usage of agrosector enterprises in the system of sustainable development of the rural territories: a case study of Ukraine. *Scientific Papers Series Management, Economic Engineering in Agriculture and Rural Development*, 20 (4), 467-476.
- Shubalyi, O., Kosinskyi, P., & Golyan, V. (2020). Economic stimulation of the development of agriculture in Ukraine due to integrated use of natural resources and waste. *Bulgarian Journal of Agricultural Science*, 26 (2), 323-331.
- Shvorak, A., Filiuk, D., Koretska, N., Vahnovska, N., Brodska, I., & Tendyuk, A. (2020). The problems of implementation and regulation of land market in the agricultural sector of Ukraine. *Scientific Papers Series Management, Economic Engineering in Agriculture and Rural Development*, 20 (2), 445-451.
- Skrypnyk, A., Zhemoyda, O., Klymenko, N., Galaieva, L., & Koval, T. (2021). Econometric analysis of the impact of climate change on the sustainability of agricultural production in Ukraine. *Journal of Ecological Engineering*, 22 (3), 275-288.
- Sokil, O., Zhuk, V., & Vasa, L. (2018). Integral assessment of the sustainable development of agriculture in Ukraine. *Economic Annals-XXI*, 170 (3-4), 15-21.
- Sonko, Y., Lazebna, I., & Lebedeva, L. (2018). Material production and GDP in Ukraine: Theoretical concept and financial assessment. *Investment Management and Financial Innovations*, 15 (2), 51-59.
- SSSU (2020). The Statistical Yearbook "Agriculture of Ukraine" for 2019. http://www.ukrstat.gov.ua/druk/publicat/kat_u/2020/zb/09/zb_sg_Ukr_2019.pdf (last accessed: 17 June 2023) (in Ukrainian)
- SSSU (2021a). The Statistical Yearbook "Agriculture of Ukraine" for 2020. http://www.ukrstat.gov.ua/druk/publicat/kat_u/2021/zb/09/zb_sg_20.pdf (last accessed: 17 June 2023) (in Ukrainian)

- SSSU (2021b). Economic Accounts of Agriculture (production account and income generation account). <http://www.ukrstat.gov.ua/> (last accessed: 17 June 2023) (in Ukrainian and English)
- SSSU (2022a). Plant Growing in Ukraine for 2021. http://www.ukrstat.gov.ua/druk/publicat/kat_u/2022/zb/05/zb_rosl_2021.pdf (last accessed: 17 June 2023) (in Ukrainian)
- SSSU (2022b). Livestock in Ukraine for 2021. http://www.ukrstat.gov.ua/druk/publicat/kat_u/2022/zb/05/zb_tv_2021.pdf (last accessed: 17 June 2023) (in Ukrainian)
- SSSU (2022c). Social and economic development of Ukraine in 2021: statistical review. http://www.ukrstat.gov.ua/druk/publicat/kat_u/2022/dop/02/dop_21_u.pdf (last accessed: 17 June 2023) (in Ukrainian)
- State Customs Service of Ukraine (2022). <https://customs.gov.ua> (last accessed: 17 June 2023) (in Ukrainian)
- State Environmental Inspectorate of Ukraine in Sumy Oblast (2022). The occupying forces caused more than 5 million hryvnias, damaging the ammonia storage in Sumy. <http://deisumy.gov.ua/?p=4350> (May 13, 2022; last accessed: 17 June 2023).
- Strapchuk, S.I., & Mykolenko, O.P. (2021). Factors of sustainable intensification in agriculture of Ukraine: Evidence from the enterprises of the Kharkivska oblast. *Scientific Bulletin of Mukachevo State University. Series "Economics"*, 8 (3), 9-17.
- Strochenko, N.I., & Koblianska, I.I. (2016). Essential and organizational transformations of economy management in the countryside as the basis of sustainable rural development in Ukraine. *Marketing and Management of Innovations*, 3, 293-308.
- Strochenko, N., Koblianska, I., & Markova, O. (2017). Structural transformations in agriculture as necessary condition for sustainable rural development in Ukraine. *Journal of Advanced Research in Law and Economics*, 8 (1), 237-249.
- Ulko, Ye., Moskalenko, A., Kucher, A., Pavlenko, O., & Serbov, M. (2022). Economic evaluation of the consequences of soil pollution in the system of sustainable land management. *Agricultural and Resource Economics*, 8 (4), 266-300.
- United Nations (2022). Lack of Grain Exports Driving Global Hunger to Famine Levels, as War in Ukraine Continues, Speakers Warn Security Council. <https://www.un.org/press/en/2022/sc14894.doc.htm> (last accessed: 17 June 2023)
- Vasylieva, N. (2019). Problems and prospects of food security in Ukraine. *Bulgarian Journal of Agricultural Science*, 25 (4), 668-676.
- Verkhovna Rada of Ukraine (2021). On amendments to some laws of Ukraine on improving the legal regulation of insurance of agricultural products with state support: Law of Ukraine No. 1601-IX of July 1, 2021. <https://zakon.rada.gov.ua/laws/show/1601-20?lang=uk#Text> (last accessed: 17 June 2023)
- Voronenko, I., Skrypnyk, A., Klymenko, N., Zherlitsyn, D., & Starychenko, Y. (2020). Food security risk in Ukraine: assessment and forecast. *Agricultural and Resource Economics*, 6 (4), 63-75.
- Wąs, A., Sulewski, P., Krupin, V., Popadynets, N., Malak-Rawlikowska, A., Szymańska, M., Skorokhod, I., & Wysokiński, M. (2020). The potential of agricultural biogas production in Ukraine — impact on GHG emissions and energy production. *Energies*, 13, 5755.
- Zbarsky, V. K., Trusova, N. V., Sokil, O. H., Pochernina, N. V., & Hrytsaienko, M. I. (2020). Social and economic determinants for the development of resource potential of small forms of agrarian production in Ukraine. *Industrial Engineering & Management Systems*, 19 (1), 133-142.

Received: November 23, 2022

Accepted: May 18, 2023

POLJOPRIVREDNA PROIZVODNJA U UKRAJINI: UVID U UTICAJ
RUSKO-UKRAJINSKOG RATA NA LOKALNU, REGIONALNU I
GLOBALNU PREHRAMBENU SIGURNOST

Jaime A. Teixeira da Silva^{1*}, Inna Koblianska² i Anatolii Kucher^{3,4}

¹Independent researcher, Ikenobe 3011-2, Kagawa-ken, 761-0799, Japan

²Department of Economics and Entrepreneurship named after Professor I.M. Briukhovetsky, Sumy National Agrarian University,
160 H. Kondratiev St., 40021, Sumy, Ukraine

³Department of Management and Organizations, Lviv Polytechnic National University, 5 Metropolita Andreia St., 79007, Lviv, Ukraine

⁴Department of Innovative Economics, External Relations and Informatization of Scientific Research, NSC "Institute for Soil Science and Agrochemistry Research named after O.N. Sokolovsky", 4 Chaikovska St., 61024, Kharkiv, Ukraine

R e z i m e

Rusko-ukrajinski rat koji je u toku, utiče na ukrajinsku poljoprivredu. Na primer, Ukrajina više nije u mogućnosti da izvozi poljoprivredne proizvode kao što su zrne kulture i žitarice morskim putem na regionalna (evropska) i međunarodna tržišta, iako je to delimično ublaženo stvaranjem „žitnog koridora”. Kao rezultat toga, prehrambena sigurnost u Ukrajini, a donekle, i u regionu (EU) i globalno, izložena je određenom riziku, posebno u zemljama koje se u velikoj meri oslanjaju na uvoz poljoprivrednih proizvoda iz Ukrajine. Oko 70% zemljišta u Ukrajini se koristi za poljoprivrednu proizvodnju. Ovaj rad daje pregled ukrajinske poljoprivredne proizvodnje koristeći statističke podatke za 2018–2022, na osnovu dostupne literature, kao i statističke podatke Organizacije Ujedinjenih nacija za hranu i poljoprivredu i zvanične statističke podatke ukrajinske vlade. Globalna proizvodnja glavnih zrnenih kultura i žitarica (pšenica, kukuruz, ječam, uljana repica i suncokret), u rasponu od 2,9 do 6,6%, pokazala je trend rasta u periodu 2017–2021. Ukrajina je činila 9, 12, 12, 14 i 50% globalnog tržišta (uvoz + izvoz) u 2020/2021. godini za pšenicu, kukuruz, ječam, repicu odnosno suncokretovo ulje. Oko 75% poljoprivrednih proizvoda i usluga (ukupno 892,852 miliona UAH) dolazi iz ratarske, a ostatak iz stočarske proizvodnje. Izvoz đubriva je zabranjen 2022. godine.

Ključne reči: poljoprivredna proizvodnja, ekonomska reforma, đubrivo, zrne kulture, predratna i posleratna obnova, pšenica.

Primljeno: 23. novembra 2022.

Odobreno: 18. maja 2023.

* Autor za kontakt: e-mail: jaimetex@yahoo.com