

## Fodder production in Ukraine: Trends, problems and prospects

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**Abstract.** During the years of Ukraine's independence, the provision of fodder to the livestock industry and their effective use remained a difficult and unsolved problem. The military aggression of the Russian Federation on the territory of Ukraine, economic, geopolitical, climatic instability, global food crisis exacerbated the pre-war problems and led to the emergence of new threats and challenges in fodder production. The purpose of the study is to assess the state and main trends of the feed market of Ukraine, the problems of the feed industry in the context of modern threats and challenges. The research uses generally accepted methods of scientific economic research, in particular: bibliometric, scientific abstraction and hypothesis, systematic and economic analysis, monographic, analysis and synthesis, complex, abstract-logical, induction and deduction, comparison and logical generalization. The main problems of Ukrainian fodder production were considered: the increase in the cost of material resources, energy resources, the increase in the cost of harvesting and storage of domestically produced fodder, the shortage of labor force due to migration and mobilization, extreme climatic conditions that affect the yield of fodder crops, the quantity and quality of fodder, non-compliance with crop rotation, low feed quality, regional redistribution of feed production and consumption, shortage of working capital, problems with reimbursement of value added tax, delays in customs clearance of imported material resources, high inflation, fixed exchange rate, problematic insurance/letter of credit instruments under export contracts, destruction of the main supply chains in Ukraine, change in the geography of exports, blockade of sea ports, high cost of created logistics chains, difficult access to the market of European countries from the point of view of import and product certification, limitation of throughput capacity of European logistics centers, etc. Attention is focused on the problems of fodder production in the de-occupied and front-line territories: a shortage of resources due to the loss of funds and property due to shelling and theft by the Russian military, the destruction of crops, the inability to export products, the death of farm animals due to military actions, damage and destruction of agricultural infrastructure and equipment, the impossibility of conducting technological operations, negative consequences for the land fund as a result of mining, artillery shelling, movement of heavy equipment, etc. The main results of the research can be used for scientific developments and in the practical activities of agricultural producers, assessing the impact of risks and threats on the fodder production industry of Ukraine

**Keywords:** fodder base; fodder crops; livestock of agricultural animals; feed market

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## INTRODUCTION

In solving the problems of socio-economic development of the country, each of the branches of the economy has an important and appropriate place. Some directly create national resources, others create conditions and infrastructure for their production, availability, maximum benefit to all sections of the population. Agricultural production is not only one of the key sectors of the Ukrainian economy, ensuring national food security, but also directly affects the world agro-food sector and global food security. The invasion of the Russian Federation into Ukraine increased the negative impact after the COVID-19 pandemic, extreme climatic events on the sustainability of the world food system, while recently the role of the Black Sea region in the world food markets has been growing (Abay *et al.*, 2023).

F. Lin *et al.* (2023) analyzed the potential impact of military aggression with duration uncertainty on global food security using a general equilibrium trade model. M. Al-Saidi (2023) notes that the war in Ukraine has led to a serious global food crisis due to complex problems in the supply and increase in prices of agricultural products that arose due to COVID-19 and political and economic difficulties. Crisis phenomena in the global food and fertilizer markets related to the hostilities in Ukraine have large-scale and long-term consequences for price policy and global food security (Hassen & El Bilali, 2022).

In the report "Assessing Food Insecurity in 2022/23 at National and SubNational Levels in 50 Countries Vulnerable to the Effects of the Ukraine-Russia Crisis" published by FAO (2022), it is noted that the current conflict between Ukraine and the Russian Federation increases the risks of further deterioration of the situation with food security at the global level.

In the work of V. Petrychenko *et al.* (2021) stated that the modern feed market is characterized by a reorientation towards the production of high-protein crops to solve the problems of food and feed protein with a steady trend towards the development of agricultural technologies, production and processing. The increase in the productivity of farm animals and the profitability of animal husbandry products requires balanced rations and a reduction in the cost of feed in the cost structure due to the use of high-protein feed. It is important for Ukraine to promote the development of the high-protein and loose feed market on an industrial basis, as well as the development of the production of organic feed and animal husbandry.

Fodder production is one of the elements of the national food chain, which provides livestock with high-quality and safe feed. Taking into account the dynamic development of the agricultural sector, the feed market, economic, geopolitical and climatic challenges,

there is a need to research trends in feed production taking into account the risks and threats of modernity. Therefore, the task of this study was a detailed study of the situation in the feed market of Ukraine, as well as an analysis of economic, political, food, global challenges and problems of agricultural production.

## MATERIALS AND METHODS

The theoretical and methodological basis of the research is a set of techniques and methods of scientific research, modern economic theory. The information base of the research is scientific developments of Ukrainian and international scientists on the economics of fodder production, legislative acts of Ukraine, official statistical materials of Ukraine, the USA and the EU.

To achieve the goal of the research, general scientific and special methods were used: bibliometric – to determine the state of the researched problem, scientific abstraction and hypothesis; system and economic analysis – to assess the state of the fodder industry; monographic – for assessing the state of feed production in dynamics; analysis and synthesis – to assess the export potential of feed production in Ukraine, determine the factors affecting the feed market; abstract-logical method, method of induction and deduction, comparison and logical generalization, complex method – for summarizing challenges, threats and problems of the fodder production industry of Ukraine, tabular – for illustrating the obtained results, graphic – for visual presentation of economic data, theoretical and methodological research material.

## RESULTS AND DISCUSSION

The current state of fodder production is characterized by a decrease in its potential, which occurs against the background of a general decrease in the pace of development of animal husbandry, a decrease in labor productivity in this field due to the limitation of opportunities to update the material and technical base and an increase in the share of the cost of feed in the cost of animal husbandry products (Korniyuchuk *et al.*, 2021).

The primary task on the way to the formation of a system of sustainable development in Ukraine is to increase the volume of production of animal husbandry products. Ukrainian animal husbandry develops in two ways: extensive and intensive. The first involves the suspension of the process of reducing the number of agricultural animals and the formation of a highly productive herd, the necessary fodder base and decent maintenance. The second is based on increasing the productivity of farm animals due to the effective use of high-quality feed and balanced diets. Today, both the first and the second method remain relevant, since the

situation in animal husbandry is critical and requires not only qualitative, but also quantitative changes.

During the period 2000-2023, the cattle population decreased by 75.6% (including cows by 72.6%), pigs by 34.7%, the poultry population increased by 36%, 2%. However, as a result of the Russian invasion of the territory of Ukraine in 2022, compared to the previous year, 15-20% of the livestock of agricultural animals was lost, in particular, the relative decline of the livestock on January 1, 2023 compared to the data on January 1, 2022 was: 15% cattle, of which 12.4% are cows, 10% are pigs and 13% are poultry (Ministry of agrarian policy..., n.d.). In such a situation, producers are forced to reorient themselves, to look for alternative ways to restore the industry. Increasing the number of farm animals for the purpose of solving food security is an extensive way of development, therefore it should take place within rational limits, taking into account the prospects of maximum use of the genetic potential of farm animals.

The livestock sector plays an important role in the development of the agrarian sector of Ukraine, however, in 2021 it occupied an insignificant share in the structure of gross agricultural production – 18.6% against 29.5% in 2010. Its main industries are cattle breeding, pig breeding, poultry farming and sheep farming. In 2021, the production of meat and livestock products amounted to UAH 71.6 billion (10.7% more than the level of 2010) or 10.1% of agricultural production at constant prices in 2016. During the period 2015-2019, an increase was observed in the production of meat of all kinds (State statistics service of Ukraine, n.d.).

The production of poultry meat has achieved a significant increase, which in 2022/2023 MR accounted for 55.2% of the country's meat balance, which is 6.8% more than in 2015/2016 MR. Pork occupies the second place – 30.8%, which is 2.6% less than in 2015/2016 MR. During the period 2015-2023, the production of all types of meat in Ukraine decreased by 9%, in particular, pork by 16.1% and beef by 29.7%, while chicken increased by 3.8% (United States department..., n.d.).

The dairy industry has also undergone fundamental changes, the reduction in the number of cows leads to a decrease in gross milk production, the volume of which in 2022 was 7,160 thousand tons, which is 32.5% less than in 2015. The majority of milk is produced by households – 66.1% in 2022, which is 8.7% less than in 2015 (United States department..., n.d.). The main factors of the decline of the industry are: the unsatisfactory state of material and technical support (including feed) of producers, the imperfection of the mechanism of state and innovative support, the low level of solvency of consumers, cyclical changes in the market, insufficient development of market infrastructure, etc.

At the same time, research by scientists V. Petrychenko *et al.* (2021) and the practice of individual farms shows that this industry is quite profitable and a priority for Ukraine. Along with the negative trends listed above, there is an increase in the productivity of cows, over the past seven years, the productivity of cows in all categories of farms has increased from 4644 kg per year to 5435 kg, or by 17%, even in the conditions of war in 2022, the increase in productivity amounted to 5.4% previous year 2021. It is clear that in agricultural enterprises the productivity of cows grows at faster rates by 14% and 4.5%, respectively (State statistics service of Ukraine, n.d.; United States department..., n.d.). The unstable price situation on the milk market reduces the interest of households in the development of dairy farming.

The main tasks for improving the market of milk and dairy products are: creation of an effective legislative framework for milk processing enterprises; forming a market for high-quality safe feed, stopping the reduction of dairy production, developing a protectionist policy, creating conditions for healthy competition and protecting consumers from low-quality products (Dzhedzhula *et al.*, 2018; Hladiy & Prosovych, 2022).

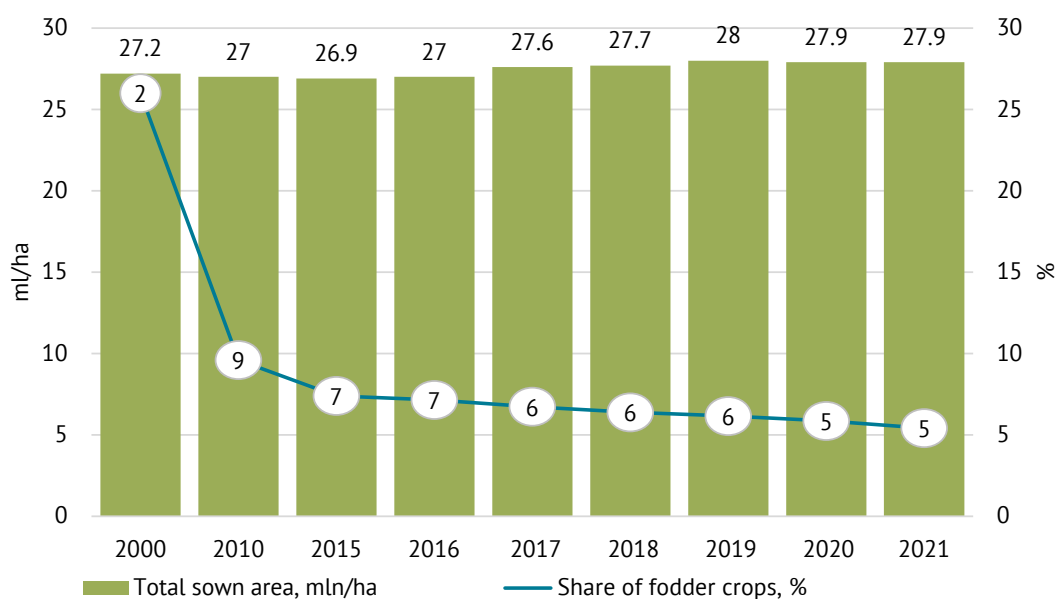
The development of livestock agribusiness has undergone a complex process, which is associated with an increase in the concentration of the industry in large farms and a decrease in small and medium-sized agricultural enterprises. One of the main tasks for agricultural enterprises specializing in animal husbandry is the organization and formation of the fodder base, which directly affects the level of productivity of farm animals, which depends on their feeding by 50-80%.

Historically, Ukrainian fodder production has never developed as an autonomous industry, although world practice convinces of the real possibilities of producers of various types of fodder to act as independent subjects of both the internal and external agrarian market, focusing on the market environment, the needs of consumers (as producers – animal breeders, as well as various intermediary structures of the trade chain), as well as own production potential and the results of internal marketing research. In contrast to them, households function at the expense of self-sufficiency and the use of public pastures, and in this way maintain a relative balance in the fodder market. However, in general, the transfer of production capacities to households has negative consequences, as it is characterized by an extensive method of management and is based primarily on the high labor intensity of the production process.

The fodder industry is divided into two main areas: field and grassland fodder production. The state of development of field fodder production in Ukraine has remained unchanged over the past few years and is characterized by a reduction in the area under fodder crops.

During the period 1990-2021, the area under fodder crops decreased from 11.9 million hectares to 1.5 million hectares, or by 87%, and during the period 2000-2021 by 78.2%. Over the past 12 years, the area under grasses has significantly decreased: perennial grasses – by 2036.7 thousand ha or 71.2%, annual grasses – by 1489.3 thousand ha or 84.9%. However, the share of perennial grasses in the total area under fodder crops increased by 12.9%, while annual grasses decreased by 7.6%. In general, the share of fodder crops in the total sown area decreased from 26% to 5.4%, or by 20.6%, in 2000-2021 (Fig. 1). The fodder production sector is divided into two main areas: field and grassland fodder production. The development of field fodder production

in Ukraine has remained unchanged over the past few years and is characterised by a reduction in the area under fodder crops. During the period 1990-2021, the area under fodder crops decreased from 11.9 million hectares to 1.5 million hectares, or by 87%, and during the period 2000-2021 by 78.2%. Over the past 12 years, the area under grasses has significantly decreased: perennial grasses – by 2036.7 thousand ha or 71.2%, annual grasses – by 1489.3 thousand ha or 84.9%. However, the share of perennial grasses in the total area under fodder crops increased by 12.9%, while annual grasses decreased by 7.6%. In general, the share of fodder crops in the total sown area decreased from 26% to 5.4%, or by 20.6%, in 2000-2021 (Fig. 1).



**Figure 1.** Share of fodder crops in the total sown area in Ukraine

**Source:** developed by the authors according to the State statistics service of Ukraine (n.d.)

Modern approaches to the development of fodder production in Ukraine have remained constant, focused exclusively on the course of development of Ukrainian animal husbandry, which determines both quantitative and qualitative criteria for fodder production, its directions, volumes, and prospects. Under such isolated conditions of development, Ukrainian fodder production is deprived of the status of an independent branch of agriculture, which entails gaps in the state's policy regarding the introduction of stabilizing and stimulating measures. At the corporate level, there are also no economic motives for investment interest from both internal business entities and external ones.

Onion-pasture production in Ukraine is just beginning to develop, 7.7 million hectares of fallows, hayfields and pastures require cultivation and the use of agro-innovative technologies. To ensure food security, Ukrainian commodity producers must produce

8,230,000 tons of milk, 135,000 tons of beef, 600,000 tons of pork, 1,620,000 tons of poultry meat, and 14,100 million pieces of meat. eggs With rational feeding of agricultural animals and poultry, 1 ton of fodder should ensure the production of 1 ton of milk with appropriate quality indicators, 0.13 ton of cattle meat, 0.3 ton of pig meat, 0.45 ton of poultry meat and 5.5 thousand eggs. Under such conditions, consumption of livestock products per capita in Ukraine will reach: meat 54 kg (born 83 kg), milk 200 kg (born 380 kg), eggs 280 pcs. (born 290 units). Therefore, in 2023, in order to produce the forecasted volumes of livestock products, the fodder industry must ensure the procurement of bulk fodder at the level of: 1.7 million tons of hay; 7.6 million tons of silage and 8.5 million tons of silage (Hadzalo *et al.*, 2022).

In the structure of the cost of livestock production, feed accounts for the main share of costs, so in the cost of milk, the share of feed is 50-55%, the cost of beef is

65-70%, the cost of products in pig and poultry production is 70-80%, therefore the quality and price of feed directly affect financial condition of animal husbandry. The procurement of high-quality feed that meets the physiological needs of animals and has a high nutritional value is a direct way to reduce the cost of meat and dairy products and improve the economy of the industry. In order to ensure obtaining high-quality grass fodder, it is necessary to strictly follow the basic recommendations for early spring care of fodder areas. (Sidorov *et al.*, 2023).

Provision and effective use of fodder is a complex and unsolved problem of the entire period of reforming the livestock industry, which is constantly in the field of view of scientists and producers. The problems that exist in the field of animal husbandry can be realistically overcome by applying new approaches to intensification in the direction of increasing the level and quality of feeding, transfer of innovations. The basis of the feed base in animal husbandry is concentrated feed, which is evidenced by the dynamics and structure of livestock and poultry feed costs in all categories of enterprises.

The share of concentrated feed in the structure of all feed costs is gradually increasing, which is explained by several factors, including: their high energy value due to the highest protein content among all feed resources; valuable mineral and vitamin composition; the possibility of importing concentrated feed (especially combined) and using it within reasonable limits as an

alternative to other types of feed; revival of domestic feed mills. The use of concentrated feeds in animal husbandry has tripled over the period from 2000 to 2021, and their share has exceeded the level of the indicator in 1990. However, the structure of the consumption of concentrated fodder by the livestock industry has changed. According to experts' estimates, in 2020-2022, about 60% of compound feed will be consumed by poultry farms and about 25% by pig enterprises. Cattle account for less than 20% of the combined feed consumed. This is explained by the rapid growth of the poultry population in Ukraine over the past few years and the decline in cattle production and its decline (State statistics service of Ukraine, n.d.). The fodder industry of Ukraine is the key to the development of animal husbandry. The technology of compound feed production includes various types of operations that must be carried out in order to achieve the maximum realization of the potential feed value of feed components. The compound feed market has changed significantly in recent years - many new companies have appeared; fierce competition promotes the development of the feed industry; the main stimulating factor is "price → quality". The production of industrial feed increased over the past seven years until 2019, and from 2020, due to the pandemic, it began to decrease. In general, the total production of compound feed decreased for the period 2015-2021 in all categories by 8.6%, and of feed premixes by 36.4% (Table 1).

**Table 1.** Production dynamics of the main types of industrial feed in Ukraine, thousand tons

| Types of feed                 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | Change, % |
|-------------------------------|------|------|------|------|------|------|------|-----------|
| Compound feeds in total       | 6192 | 6232 | 5984 | 6025 | 6464 | 6302 | 5657 | 8.6       |
| - for pigs                    | 1395 | 1440 | 1107 | 1210 | 1229 | 1236 | 1264 | 9.4       |
| - for cattle                  | 722  | 738  | 592  | 724  | 701  | 744  | 645  | 10.7      |
| - for poultry                 | 3884 | 4032 | 3745 | 4091 | 4534 | 4322 | 3748 | 3.5       |
| Premixes for farm animal feed | 60.2 | 52.8 | 55.3 | 67.9 | 78.6 | 60.0 | 38.3 | 36.4      |

**Source:** compiled by the authors based on data from the State statistics service of Ukraine (n.d.)

The most important task for the development of industrial fodder production in modern conditions is the restoration and improvement of industrial and economic relations both with suppliers of grain and industrial waste during the processing of agricultural products, and with consumers of compound feed. According to experts (Petrychenko *et al.*, 2021), the growth of feed production is adequate to the growth of animal husbandry needs, and their deficiency will still be covered by the import of feed components.

In this case, regulatory and legal support of fodder production plays an important role. In 2020, Law

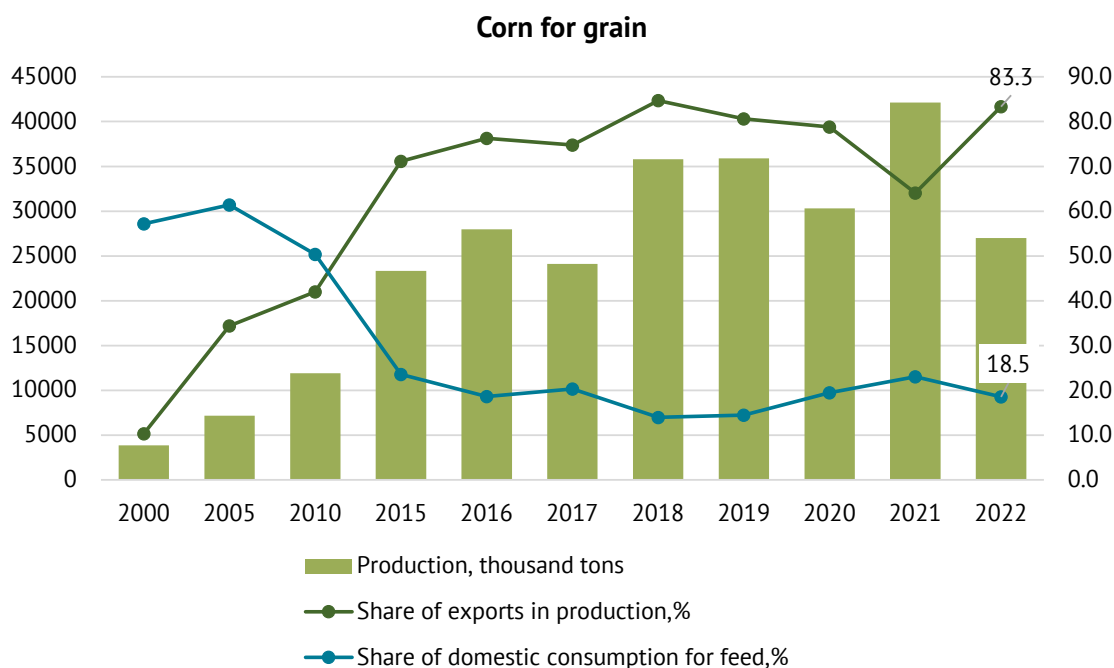
of Ukraine No. 2264-VIII "On the safety and hygiene of fodder" (2017), which defines the legal and organizational principles of guaranteeing the safety of fodder in the process of its production, circulation and use, in particular, establishes requirements for hygiene, labeling, packaging and presentation of fodder, regulates relevant public relations between market operators and state authorities.

In the last decade, poultry farming began to develop within large holding agro-formations created on the basis of vertical integration. Such complexes also include combined feed plants, which independently

supply livestock units with fodder, including combined feed. About half of the production of compound feed in Ukraine is accounted for by such compound feed plants. The raw material base for feed mills is formed by producers of grain (corn, fodder wheat) and oil crops (soybean, sunflower, rapeseed). If in 2000, Ukraine produced 10.2 million tons of wheat, of which 16.7% was used for livestock and poultry feed, and only 0.8% was exported, then in pre-war 2021, production increased to 33 million tons (almost in 3 times), for feed – 12.1%, export – 57.1%. Russian aggression on the territory of Ukraine in 2022 caused a sharp decrease in production to 21

million tons (36.4%), the share of domestic consumption increased to 19%, and exports to 64.3% (State statistics service of Ukraine, n.d.).

A similar situation developed on the corn grain market (Fig. 2). During the period 2000-2021, Ukraine increased the production of this crop from 3.8 million tons to 42 million tons or 11 times, exports increased from 10.3% to 64%, and domestic consumption from 57.2% to 18.5%, and overall domestic consumption decreased by 50%. In the last year of 2022, production decreased in relation to the previous year 2021 by 36%, consumption by 48.5%, exports by 16.6%.



**Figure 2.** Production, consumption and export of corn for grain, thousand tons

**Source:** developed by the authors based on the State statistics service of Ukraine (n.d.), United States department... (n.d.)

Disruption of logistics, export problems, blockade of sea ports, occupation of commodity production zones are the main reasons for destabilization of the grain sector in 2022. In general, during the years of independence, the oil and fat industry developed, where, along with the traditional culture of sunflower, the production of soybeans and rapeseed is developing. The increase in the production potential of these crops occurred due to the expansion of sown areas and increased yields. For the economy of Ukraine, these crops are of strategic importance as both food (oil) and feed crops (meal, cake). Ukrainian sunflower, meal and oil are in demand on the world market and form a significant part of the balance of feed protein on the European market. The value of protein-oil crops as the most important source of vegetable protein and oil increases in connection with the growth of the population, in the formation of food resources, adequate nutrition,

improvement of health and prolongation of human life. EU countries import up to 14 million tons of soybeans and 18.3 million tons of soybean meal from the USA, Brazil, Canada, and Paraguay. Ukraine provides EU countries with 37% rapeseed, 73% sunflower meal and 28% rapeseed oil. The use of meal of protein-oil crops in feeding animals and poultry is a new era, the main and strategic direction in the supply of high-protein feed, ensuring complete feeding and increasing their productivity (Petrychenko *et al.*, 2021). In the structure of world meal production, soybean meal makes up 68.4% of all meal. Soybean meal differs from other high-protein ingredients in its balanced amino acid composition, and has feeding features that are still little known in Ukraine. In terms of fodder benefits, soybean meal surpasses all other vegetable sources of protein, has the highest nutritional value, the widest use in feeding, is suitable for all types of animals, poultry and fish.

The use of sunflower and rapeseed meal in the rations of feeding cows, which leads to an increase in the protein content, helps to strengthen the metabolic processes in the animal's body, improves their physiological condition and increases milk productivity. The practice of using these

types of meal is quite common in European countries (European Union, n.d.). It is preliminarily estimated that the export of sunflower meal from Ukraine in 2022/2023 MR will make up 77.5% of gross production, which is 4.1% more than the level of 2021/2022 MR (Table 2).

**Table 2.** Production, consumption and export of sunflower seed meal, thousand tons

| Year               | Sunflower seed meal |                      |         | Share of exports in production, % |
|--------------------|---------------------|----------------------|---------|-----------------------------------|
|                    | Production          | Domestic consumption | Exports |                                   |
| 2010/2011          | 3296                | 390                  | 2927    | 88.8                              |
| 2015/2016          | 4811                | 1000                 | 3817    | 79.3                              |
| 2016/2017          | 6030                | 1300                 | 4807    | 79.7                              |
| 2017/2018          | 5679                | 1300                 | 4238    | 74.6                              |
| 2018/2019          | 6112                | 1350                 | 4808    | 78.7                              |
| 2019/2020          | 6455                | 1350                 | 5181    | 80.3                              |
| 2020/2021          | 5679                | 1275                 | 4396    | 77.4                              |
| 2021/2022          | 4460                | 1200                 | 3275    | 73.4                              |
| 2022/2023          | 4130                | 1050                 | 3200    | 77.5                              |
| Growth index       | 1.25                | 2.69                 | 1.09    | *                                 |
| Absolute growth, ± | 834                 | 660                  | 273     | 11.3                              |

**Source:** compiled by the authors based on data from the State statistics service of Ukraine (n.d.), United States department... (n.d.)

Since 2010, the total export value of sunflower meal has increased by 9.3% with a 25% increase in production. Ukraine has long held a leading position in the world market of sunflower meal: in 2020/2021 MR – 28%, in 2021/2022 MR – 23.4%, in 2022/2023 it is expected to be at the level of 20.1%.

Canola meal provides an amino acid balance that targets the required amino acid profile of the pig better than any other plant protein (Hein, 2020). The production of rapeseed meal for the period 2010/2011 MR 2022/2023 MR is expected to increase more than 2 times, domestic consumption by only 33%, export by 59%.

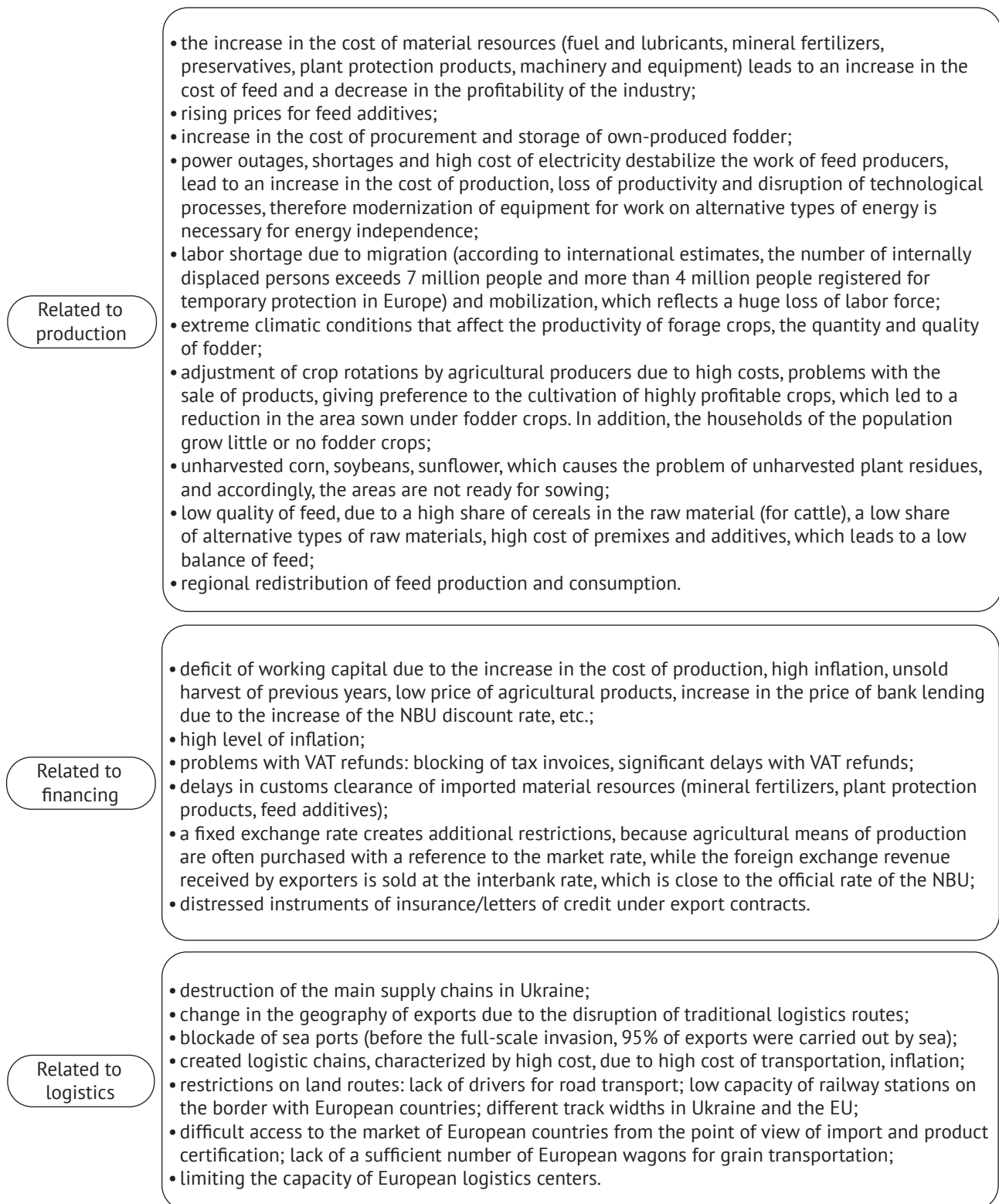
Due to the significant volume of solvent demand, the market of the European Union is able to continue to absorb products produced in Ukraine. The needs of the countries of the European Union are covered in protein by only 38% (European Union, n.d.). Taking into account the current trends, we can safely predict a further increase in the volume of deliveries to this market. However, there is a threat that Ukraine will be limited only by production capacity. Therefore, there is a need to shift the emphasis on the processing of grain and oil crops, in particular soybean and rapeseed.

The pre-war problems and challenges of fodder production were complicated by the military aggression of the Russian Federation from February 2022.

Economic, political and ecological instability, the aggravation of the global food problem, led to the emergence of new threats and challenges for fodder production in Ukraine.

Research by scientists V. Petrychenko *et al.* (2022) testify that under the conditions of martial law in Ukraine, logistical connections for the supply of fodder and the sale of livestock products are disrupted, which prompts producers to look for alternative options. Ukraine imported some feed and veterinary drugs, but due to the war and logistical problems, their purchase is currently limited. Production of the projected amount of fodder is complicated by a shortage of energy and human resources, as well as unstable weather conditions.

The current state of the Ukrainian market of fodder and fodder resources calls into question its effective performance of the function of ensuring the food security of the state in terms of the production of livestock products. Feed supply is based on the use of domestically produced feed, increased competition between Ukrainian commodity producers and suppliers of biological feed additives, and the low level of development of industrial feed production (Voronetska *et al.*, 2020). Thus, it is possible to identify a number of key factors inhibiting the development of fodder production in Ukraine (Fig. 3).



**Figure 3.** Problems and challenges of the fodder production industry in Ukraine

**Source:** compiled by the authors according to *Agribusiness of Ukraine during the war... (2022)*

The military aggression of the Russian Federation in Ukraine led to an increase in feed and energy prices, a shortage of feed raw materials, and problems in logistics chains, which lead to an increase in

production costs. Issues related to the neutralization of the consequences of hostilities in de-occupied regions and front-line territories require special attention (Fig. 4).



Associated with the consequences of hostilities in the de-occupied and front-line territories

- lack of resources due to loss of funds and property due to shelling or theft by the Russian military, destruction of crops, untimely harvest, low prices for products or inability to export products;
- the death of farm animals due to hostilities;
- damage and destruction of agricultural infrastructure and equipment: warehouses, granaries, fodder storage facilities, agricultural machinery and equipment;
- occupation of enterprises, theft and removal of crops, machinery, equipment and other means of production;
- the impossibility of carrying out technological operations (introduction of chemical fertilizers, fertilizing, harvesting, irrigation) due to the mining of fields and proximity to the combat zone;
- negative consequences for the land fund as a result of mining, artillery shelling, movement of heavy equipment;
- part of the sown areas, which was not cultivated last year, is characterized by increased weediness, pollution by pests and diseases;
- agricultural producers in the front-line territories do not have the opportunity to take advantage of preferential taxation and preferential lending;
- lawsuits for non-payment of credit debts;
- lawsuits for accrued utility services for enterprises that were under occupation and did not actually consume these services;
- increased level of risks of logistics operations in de-occupied and front-line territories.

**Figure 4.** Problems and challenges of fodder production in the de-occupied and frontline territories

**Source:** compiled by the authors according to *Agribusiness of Ukraine during the war... (2022)*

In order to provide animal husbandry with high-quality fodder balanced by the content of nutrients, it is necessary to develop the fodder production system, including the field and onion-pasture direction (Yurchuk *et al.*, 2022). Increasing the productivity of forage crops can be achieved in two ways: by optimizing the structure of forage crops on irrigated and non-irrigated lands and by using energy-saving technologies for their cultivation (Holoborodko *et al.*, 2020).

Databases of promising breeding material of fodder crops have been formed in Ukraine (The state register of plant varieties..., n.d.). Every year, Ukrainian scientists and breeders create and introduce new high-yielding varieties of forage crops, legumes and grasses with increased quality indicators and productivity. In addition, fodder crops can be used for reclamation of degraded, unproductive and technologically polluted lands, organic farming, etc.

The experience of other countries shows that in the conditions of globalization, commodity fodder production is developing, as the most optimal way of market orientation is the formation of specialized fodder production enterprises to meet the needs of small and medium-sized agribusiness (Sprynchuk, 2020).

I. Cherevko (2022) proposes to apply the Polish experience in the development of fodder production and the provision of livestock feed in Ukraine. Noting that based on the key trends in the development of fodder production in the world, the main ways of its further development in Ukraine relate to increasing the level of their ecological safety, developing the use

of active feed additives, in particular of a medicinal nature, optimizing the structure of fodder and feeding animals, improving the quality of fodder and the possibility of changing their structure production, intensification of fodder production by households, – increasing the efficiency of fodder use, specialization in fodder production, innovation and digitalization of the industry, which will become fully possible in Ukraine after the end of hostilities and ensuring the possibility of safe farming in the de-occupied territories (Cherevko, 2022).

To ensure the sustainability of agriculture, local resources for agricultural production and feed production, such as land, forests, water ecosystems, must be protected from pollution and over-extraction of nutrients. It is necessary to improve sustainable agricultural practices by increasing the efficiency of nutrient use, increasing nutrient recycling, reducing waste, increasing agricultural production, reducing greenhouse gas emissions, and increasing agricultural productivity through the integration of industries. The integration of agricultural production has enormous potential to improve nutrient recycling or recovery (Adegbeye *et al.*, 2020). Research confirms that the transfer of innovations of self-renewing agriculture allows for the rational use of natural resources both in terms of ecological and economic components and to achieve effective and long-term growth (Petrychenko *et al.*, 2022).

The significant potential of the feed production industry of Ukraine allows us to meet not only our own needs for feed protein, but also to enter the global

feed market as a supplier of deep processing products. A comprehensive approach with support at the local, state and international levels is necessary to solve the problems and challenges of fodder production and to restore the activities of agricultural producers. It is necessary to carry out the restructuring of sown areas, agro-technological approaches to the technology of growing fodder, use special equipment for demining agricultural lands, consolidate at the international and state levels support for the fodder industry, develop special programs to stimulate the development of animal husbandry, first of all dairy cattle breeding in the small and medium segment agribusiness. It is necessary to develop sustainable ecologically safe fodder production, which will contribute to the development of all branches of agriculture and create opportunities for the development of value-added production.

### CONCLUSIONS

Animal husbandry of Ukraine plays an important role in ensuring food security and the development of the agricultural sector, although the share of the livestock industry in the structure of gross agricultural production in 2021 is only 18.6%. Cattle population decreased by 75.6% (including cows by 72.6%), pigs by 34.7% during the period 2000-2023. The decrease in the number of cows causes a decrease in gross milk yield, the volume of which in 2022 was 7,160 thousand tons, which is 32.5% less than the level of 2015. The level of productivity of farm animals depends on their feeding by 50-80%, so the main task of producers is to provide high-quality fodder for farm animals. The development of field fodder production in Ukraine is characterized by a 78.2% reduction in fodder crops for the period 2000-2021. Over the past 12 years, the area sown with perennial grasses has significantly decreased by 71.2%, annual grasses by 84.9%. Concentrated fodder is the basis

of the fodder base of animal husbandry, their use in 2021 compared to 2000 has increased three times. The raw material base for concentrated feed is grains (corn, fodder wheat) and oil crops (soy, sunflower, rapeseed).

The military aggression of the Russian Federation in Ukraine led to deepening of the problems of the agricultural sector, in particular, fodder production. The projected increase in the demand for livestock products requires an increase in feed production. Fodder plays a central role in ensuring adequate feeding of animals. A diet balanced in terms of all nutrients and at a level that meets the production goal, taking into account the animal's physiological state, is a prerequisite for achieving high and sustainable animal productivity.

The production of the projected amount of fodder in the conditions of martial law is complicated by the shortage of energy and human resources. In Ukraine, it is necessary to increase its own production of feed, increase its effective use, which will reduce dependence on imported feed ingredients, as well as reduce the cost of feeding. In conditions of limited resources, the problem of fodder shortage can be solved thanks to sowing of annual and perennial grasses, grain-legume mixtures, grass mixtures, because scientifically based mixtures of fodder crops will be able to almost completely provide nutrients to farm animals and form their own market for fodder. Prospects for further scientific research consist in the formation of measures for the restoration and development of fodder production in Ukraine under the influence of threats created by the military aggression of the Russian Federation.

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### CONFLICT OF INTEREST

None.

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## Кормовиробництво в Україні: тенденції, проблеми і перспективи

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**Анотація.** За роки незалежності України забезпечення кормами галузі тваринництва та їх ефективне використання залишалися складною і невирішеною проблемою. Військова агресія РФ на території України, економічна, геополітична, кліматична нестабільність, глобальна продовольча криза загострила довоєнні проблеми і зумовила виникнення нових загроз і викликів у кормовиробництві. Метою дослідження є оцінка стану і основних тенденцій ринку кормів України, проблем кормовиробничої галузі в контексті сучасних загроз і викликів. У дослідженні використано загальноприйняті методи наукових економічних досліджень, зокрема: бібліометричний, наукової абстракції та гіпотези, системного та економічного аналізу, монографічний, аналізу і синтезу, комплексний, абстрактно-логічний, індукції та дедукції, порівняння та логічного узагальнення. Було розглянуто основні проблеми українського кормовиробництва: зростання вартості матеріальних ресурсів, енергоресурсів, здорожчання процесів заготівлі і зберігання кормів власного виробництва, дефіцит робочої сили внаслідок міграції і мобілізації, екстремальні кліматичні умови, які впливають на урожайність кормових культур, кількість та якість кормів, недотримання сівозмін, низька якість кормів, регіональний перерозподіл виробництва і споживання кормів, дефіцит обігових коштів, проблеми з відшкодуванням податку на додану вартість, затримки з митним оформленням імпортованих матеріальних ресурсів, високий рівень інфляції, фіксований валютний курс, проблемні інструменти страхування/акредитивів за експортними контрактами, руйнування основних ланцюгів постачання в Україні, зміна географії експорту, блокада морських портів, висока вартість створених логістичних ланцюжків, ускладнений доступ на ринок країн Європи з точки зору імпорту та сертифікації продукції, обмеження пропускнуої спроможності європейських логістичних центрів, тощо. Зосереджено увагу на проблемах кормовиробництва на деокупованих і прифронтових територіях: дефіцит ресурсів через втрати коштів і майна внаслідок обстрілів і крадіжок російськими військовими, знищення посівів, неможливості вивезти продукцію, загибель сільськогосподарських тварин через воєнні дії, пошкодження й руйнування аграрної інфраструктури та техніки, неможливість проведення технологічних операцій, негативні наслідки для земельного фонду внаслідок замінування, артобстрілів, руху важкої техніки, тощо. Основні результати дослідження можуть бути використані для наукових розробок і у практичній діяльності агровиробників, оцінюванні впливу ризиків і загроз на кормовиробничу галузь України

**Ключові слова:** кормова база; кормові культури; поголів'я сільськогосподарських тварин; ринок кормів