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Economic Efficiency of Exporting Queen Bees and Bee Packages from America to Canada and England

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Abstract: *The relevance of the study is due to the high demand for high-quality queen bees and bee packages in countries with insufficient domestic production, in particular in Canada and England. The limited queen rearing season in northern climates and the need for a stable supply of high-quality breeding material create significant opportunities for expanding exports from the Americas. At the same time, the efficiency of such exports depends on numerous economic and logistical factors, which requires a detailed analysis. **The purpose** of the article is to comprehensively assess the economic efficiency of exporting queen bees and bee packages from America to Canada and England, taking into account the specifics of market conditions, costs, logistics and profitability. **The research methods** are based on the use of economic, statistical and comparative analysis, a systematic approach and expert assessments. **The results of the study** indicate a significant potential for American exports of queen bees and packages due to high quality products and favorable growing conditions. The main factors affecting the economic efficiency of exports are identified: production costs, transportation costs, certification and*



*customs clearance. It is proved that the demand for imported queen bees in Canada and England remains consistently high due to limited domestic production capacity. **The conclusions of the study** emphasize the importance of optimizing production and logistics processes, improving certification and customs clearance procedures, as well as actively introducing modern breeding methods to ensure high competitiveness of American exporters in the international market. Practical recommendations for increasing the profitability of export operations and expanding cooperation with Canadian and British partners are proposed. The results obtained are important for the formation of an effective export strategy and the development of international cooperation in the field of beekeeping.*

Keywords: *international trade, profitability, logistics costs, customs procedures, certification, competitive environment.*

Економічна ефективність експорту бджолиних маток та бджолиних пакетів з Америки до Канади та Англії

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Анотація: *Актуальність дослідження зумовлена високим попитом на якісні бджолині матки та бджолині пакети в країнах із недостатнім внутрішнім виробництвом, зокрема в Канаді та Англії. Обмежений сезон вирощування маток у північних кліматичних зонах та потреба в стабільному забезпеченні високоякісного племінного матеріалу створюють значні можливості для розширення експорту з Америки. Водночас ефективність такого експорту залежить від численних економічних і логістичних факторів, що потребує детального аналізу. **Метою** статті є комплексна*



оцінка економічної ефективності експорту бджолиних маток і бджолиних пакетів з Америки до Канади та Англії, з урахуванням особливостей ринкових умов, витрат, логістики та прибутковості. **Методи дослідження** ґрунтуються на застосуванні економіко-статистичного й порівняльного аналізу, системного підходу та експертних оцінок. **Результати** дослідження свідчать про значний потенціал американського експорту бджолиних маток і пакетів завдяки високій якості продукції та сприятливим умовам вирощування. Визначено основні чинники, що впливають на економічну ефективність експорту: виробничі витрати, витрати на транспортування, сертифікацію та митне оформлення. Доведено, що попит на імпортованих бджолиних маток у Канаді та Англії залишається стабільно високим через обмежені внутрішні можливості виробництва. **Висновки дослідження** підкреслюють важливість оптимізації виробничих і логістичних процесів, удосконалення процедур сертифікації та митного оформлення, а також активного впровадження сучасних методів селекції для забезпечення високої конкурентоспроможності американських експортерів на міжнародному ринку. Запропоновано практичні рекомендації щодо підвищення прибутковості експортних операцій та розширення співпраці з канадськими та англійськими партнерами. Отримані результати мають важливе значення для формування ефективної стратегії експорту та розвитку міжнародної співпраці в галузі бджільництва.

Ключові слова: міжнародна торгівля, прибутковість, витрати на логістику, митні процедури, сертифікація, конкурентне середовище.

Statement of the problem. The export of queen bees and bee packages is a promising area of international trade, which plays an important role in ensuring the effective functioning and development of beekeeping in different countries. In particular, countries such as Canada and England have a high demand for high-



quality bee packages and breeding materials to increase the productivity of their apiaries, which creates opportunities for expanding exports from the United States. At the same time, this process's efficiency depends on several economic, logistical, and legal factors that require detailed analysis.

Despite the high demand, there are certain problems related to optimizing production costs, transportation and certification of queen bees and packages. In addition, it is important to set a competitive price that considers product quality, market conditions and import requirements in Canada and England. The absence of a comprehensive approach to assessing the economic efficiency of exports makes it difficult to make informed management decisions and increase business profitability.

Thus, there is a need to study the economic efficiency of exporting queen bees and bee packages from America to Canada and England, considering market characteristics, logistics costs, customs procedures, certification, and the competitive environment. Determining optimal export strategies will increase supply volumes and improve the economic performance of exporting companies.

Analysis of recent research and publications. The analysis of recent research and publications shows little scientific and practical interest in studying issues related to the export of queen bees and bee packages. The works of foreign and domestic scientists emphasize the importance of ensuring high-quality breeding material, optimizing logistics processes and increasing the economic efficiency of beekeeping activities. Studies by R. Brodschneider et al. [1] and R. Buchler et al. [2] focus on the logistics efficiency of queen bee exports from the USA to Europe. The authors emphasize the need to reduce costs and shorten delivery times, directly affecting bee packages' quality and survival. The work of L.V. Dicks et al. [3] and S. A. Khalifa et al. [4] emphasize the market demand in Canada, where high-quality breeding material is important to increase apiary productivity, which creates demand for products of American producers.



The works of Y. Perehuda [5; 6] are devoted to studying the impact of innovations on competitiveness in agriculture, which directly affects the efficiency of product exports. The introduction of modern technologies into production contributes to a significant increase in process efficiency, reducing costs and improving product quality. This is a crucial factor for successful exports to developed countries. The author emphasizes that innovative approaches contribute to creating more efficient supply chains, leading to increased exports and improved competitiveness of Ukrainian products in international markets. Given the constant development, innovations are an important tool for attracting new markets and strengthening positions in existing ones.

F. Mondet et al. studied the economic aspects of exporting bee packages, particularly certification and customs procedures that increase the final cost of products. The works of R. Moritz, S. Erler [8] and F. Nainu [9] are devoted to analyzing the competitive environment in the queen bee market in Europe, where the authors identify the main factors influencing the choice of suppliers, including quality, price and logistics capabilities. K. S. Traynor [10] discusses the genetic diversity of queen bees as a factor in increasing the productivity of apiaries, which is an important argument in favor of importing high-quality breeding material.

Identification of previously unresolved parts of the overall problem. Despite the existence of these studies, several unresolved issues remain. In particular, there is a lack of comprehensive approaches to analyzing the economic efficiency of exports that would consider all stages of the process, from production to delivery. No studies have also compared the specifics of the Canadian and English markets, considering their regulatory requirements and market conditions. In addition, researchers often overlook economic factors such as logistics costs, customs duties, and pricing optimization.

Thus, this study must fill these gaps. The article proposes a comprehensive approach to assessing the economic efficiency of exporting queen bees and bee



packages from America to Canada and England, considering both costs, profits, and market conditions. This will allow producers to make informed management decisions by optimizing logistics processes, pricing policy and strategy for entering international markets.

Formulation of the objectives of the article (statement of the task). The article aims to comprehensively assess the economic efficiency of exporting queen bees and bee packages from America to Canada and England, considering the specifics of market conditions, cost level, logistics aspects and profitability indicators. To achieve this goal, the following tasks have been set:

- to analyze the current state of the queen bee and bee packages market in Canada and England;
- Identify the main factors that affect the economic efficiency of exports, including the costs of production, transportation, certification, and customs clearance;
- to develop practical recommendations for improving the competitiveness of American exporters in the international market.

Summary of the main research material. The production of queen bees and bee packages is an important part of beekeeping, which affects the productivity, stability, and health of bee colonies and ensures the economic efficiency of this activity. One of the main aspects of this process is the selective breeding of honey bees, which helps increase yields, reduce colony losses, and improve resistance to diseases and parasites, particularly the Varroa mite. Thanks to selection, the need for chemicals is reduced, which positively impacts the environment.

Breeding for Varroa resistance is costly, as it requires significant production costs and depends on different beekeeping methods and variations in the national labor market. However, it is an important element to ensure the long-term stability and productivity of the industry. Queen production is usually organized as an “economy of scale”, which makes it possible to reduce costs by scaling up



production. Often, queen production is seen as a complementary business to the main business of honey production, where the main profit covers the costs of breeding them [11].

The main driving force behind queen production is economic factors, including meeting customer demand, ensuring stable cash flow, and rational use of resources. At the same time, another important motive is to obtain high-quality reproductive material for their beekeeping activities. In addition to economic benefits, there are also intangible factors such as traditions, prestige, and the desire to produce the best quality queen bees.

The efficiency of bee packages and queen production depends largely on cooperation with scientific institutions and performance testers. Such interaction helps to improve the genetic characteristics of reproductive material and ensure locally adapted breeding stock, which is important for sustainable beekeeping. Previous studies show that using local breeding bees adapted to specific conditions provides better productivity and colony stability results.

It is estimated that between 250 and 500 beekeepers in Canada raise queen bees for their own use and/or for sale to other Canadian beekeepers [12]. According to provincial surveys from 2017 to 2018, about 100,000 queen bees were raised in Canada, which is only a small fraction of the need to meet the national demand for more than 800,000 Canadian bee colonies. A conservative estimate is that half of these colonies require queen replacement each year [13], suggesting that at least 400,000 queen bees need to be produced annually to maintain current colony numbers. This is a serious problem due to the limited queen production season in Canada, which creates a demand for queen imports from warmer climates such as Hawaii, California, New Zealand, and Australia. A significant portion of queen bee imports to Canada occur in the spring, when Canadian beekeepers receive them from California, where the climate is conducive to breeding bees much earlier than in northern regions. They are also actively imported from New Zealand, Australia, and



Hawaii, where bee breeding is carried out throughout the year due to favorable climatic conditions. According to the Canadian Association of Professional Beekeepers (CAPA), during the winter of 2022-2023, the average loss rate of bee colonies reached 32.2%, which exceeds the average annual rate of 27% recorded from 2007 to 2022. The most difficult winter in recent decades was the winter of 2021-2022 when losses reached 45.5%, which is almost twice the average of previous years [14] (Fig. 1).

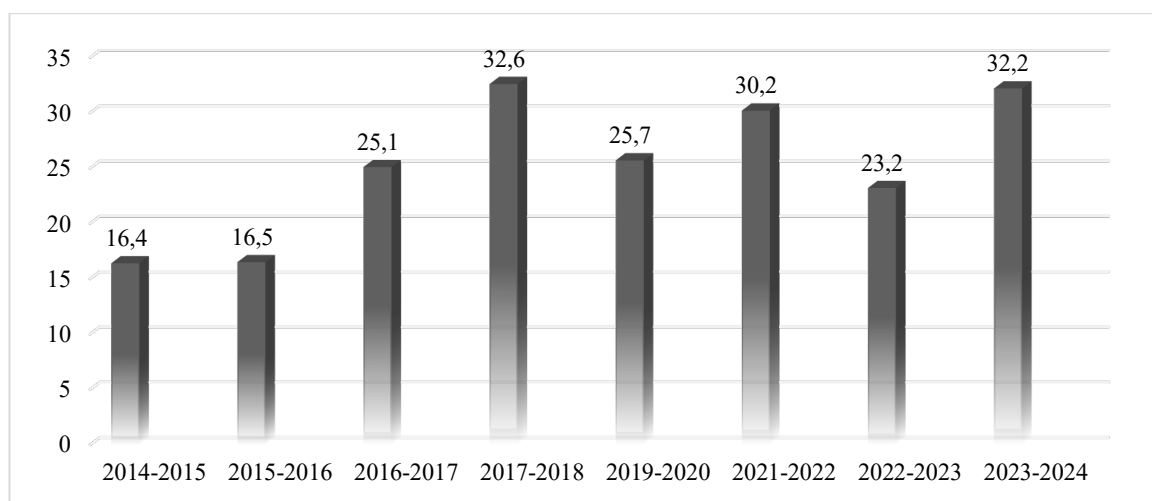


Figure 1. Level of bee colony losses in Canada in winter, 2014-2024.

Source: compiled by the author based on [14].

To preserve bee colonies, Canadian beekeepers actively import queen bees from warm countries such as the United States, Chile, Australia, New Zealand, Denmark, Italy, and Malta. In 2023 alone, more than 343,125 queen bees were imported into Canada, most of which came from California and Hawaii. The high dependence on imports is due to the need to quickly restore the bee population to ensure effective pollination and stable honey production. However, this practice also has its risks. This is a potential threat of introducing new diseases and parasites, which can further complicate the situation with the survival of bee colonies. In



addition, imported queens do not always successfully adapt to Canadian conditions, which can reduce the colony's efficiency in the long run.

The English queen bee market is also partially dependent on imports, although the extent of this dependence is less than in Canada. Due to the more temperate climate, the loss of bee colonies in winter is lower, which reduces the need for regular replenishment of the population through imports. At the same time, England also has bee health issues, particularly due to the spread of diseases and parasites, which stimulate demand for high-quality and disease-resistant queen bees.

The requirements for importing honeybees from the United States into Canada are set by the Canadian Food Inspection Agency (CFIA) and include strict regulations on documentation, certification and the health status of the bees. To import honey bees, you must obtain a permit that is issued prior to the importation of products or animals. The application for this permit must be submitted to the local CFIA office in advance. In addition, the exporter must provide an export certificate issued by the competent authorities of the exporting country containing all the requirements stipulated in the import permit.

The import documentation must be submitted in the original or as a certified copy of the original, along with all required supporting documents, at the first border crossing. It is important to note that changes to the import conditions can only be made by a CFIA inspector; any other changes will invalidate the authorization. All supporting documentation must be in English or French and accurately describe the cargo and its country of origin. Export documentation must be issued no earlier than 30 days before export, approved by an inspector of the US Animal and Plant Health Inspection Service (APHIS) and contain the CFIA import permit number. Suppose the epizootic situation in the country of origin changes between the time the permit is issued and the shipment enters Canada. In that case, the import may be denied, or the shipment may be subject to additional quarantine, testing or treatment at the importer's expense.



There are specific requirements for certification of apiaries. They must be officially recognized as free of Africanized *Apis mellifera scutellata* genetics, as evidenced by current maps and surveillance programs for this species. Africanized bees must not have been detected within 30 miles of the apiaries within the last year. A certificate from the State Department of Agriculture confirms this information. In addition, mitochondrial DNA testing (PCR-DNA) of worker bees - offspring of exported queens - is required and must be performed no earlier than 180 days before export. Established procedures must process samples. If *A. m. Scutellate* is detected during testing; the apiary will not receive permission to export queen bees [15, p. 196].

Canada also requires the absence of the Asian honey bee (*Apis cerana*) and its hybrids in the country or region of origin. The apiary must be certified free of the main bee diseases - American Foulbrood (AFB), European Foulbrood (EFB) and Varroa mites. For this purpose, 5% or at least 25 bee families from each apiary must be randomly selected and examined for clinical signs of these diseases. The inspection should be carried out no earlier than 90 days before export. In case of detection of disease symptoms or exceeding the level of Varroa over 1% (1 mite per 100 bees), exports will be prohibited until appropriate treatment and retesting is carried out [16, p. 62].

Thus, the requirements for importing honey bees from the United States to Canada are extremely strict and aimed at preventing the spread of dangerous diseases and pests that may threaten the national beekeeping industry. Compliance with all these conditions is mandatory and requires careful documentary support and veterinary control.

An important aspect of analyzing the economic efficiency of queen bee exports is to study the reasons that encourage Canada and England to import this type of product and assess the advantages and disadvantages of such cooperation. Given the climatic features, the level of loss of bee colonies and the need to ensure



effective pollination of crops, both countries have their reasons for attracting queen bees from abroad.

Table 1 systematizes the main reasons for exporting queen bees to Canada and England, outlining this process's advantages and potential disadvantages.

Table 1

Reasons, advantages and disadvantages of exporting queen bees to Canada and England

Reasons for exporting queen bees	Advantages of exporting	Disadvantages of exporting
High mortality of bee colonies due to the harsh climate (up to 45.5% of losses)	Rapid recovery of the bee population	The risk of introducing new diseases and parasites
Problems with the preservation of bees in winter	Ensuring stable pollination of crops	Low acclimatization of imported queens to local conditions
Spread of parasites (Varroa tick, tropilaelaps ticks) and diseases	Maintaining honey production at a stable level	High import costs
Limited own production of acclimatized queen bees	Possibility to choose high-performance and disease-resistant breeds	Dependence on external suppliers

Source: author's own development

The threats posed by the export of queen bees to Canada are complex and include biological and economic risks. For example, queen bees from warmer climates often have difficulty adapting to the harsh Canadian winters. This raises doubts about their long-term viability, which the Canadian Association of Professional Beekeepers confirms. Despite scientific research to study the conditions for successful wintering, beekeepers urgently need immediate solutions.



Also, the Canadian beekeeping industry's heavy reliance on imported queens poses serious risks to production stability. If diseases or parasites are detected in bees, for example, from California, the Canadian Food Inspection Agency (CFIA) could close the border to imports, which would significantly blow the industry due to the lack of ability to quickly increase its queen production.

Another threat is logistical difficulties - some queens do not survive during transportation to Canada. Sometimes, they are delayed at delivery points for several days, leading to the death of the queen and the bees accompanying them.

In addition, there is a risk of introducing dangerous diseases and pests. The CFIA reports that imported queens can carry tropilaelaps mites, Africanized killer bees, small street beetles, amitrazproof Varroa mites and oxytetracycline-resistant American rots. All of these could have catastrophic consequences for the Canadian honey bee population.

Given these risks, the Canadian government at the federal and provincial levels is putting pressure on beekeepers to reduce their dependence on foreign queen bees. For example, Saskatchewan has a program called Saskatraz, which aims to develop its production of queen bees adapted to local climatic conditions.

To increase the competitiveness of American exporters of queen bees in the international market, it is advisable to develop measures to improve product quality, optimize logistics and increase product confidence.

First, it is important to strengthen breeding efforts to develop queen bees more resistant to different climatic conditions. This is especially true for the Canadian and English markets, where the climate significantly differs from the American one. Breeding should be aimed at adapting to harsh winter conditions, increasing immunity to common diseases and pest resistance.

Secondly, it is necessary to improve the quality control and safety system during transportation. The use of special containers that maintain optimal temperature and humidity, as well as shorter delivery times, will help reduce queen



mortality during transportation. Minimizing the time queen bees spend at transshipment points and warehouses is also important.

Third, cooperation with scientific institutions and industry associations should be expanded to develop customer support programs. This could include consulting services to help queen bees adapt to new conditions, educational programs on care and breeding, and product quality guarantees.

In addition, it is advisable to intensify marketing efforts in international markets, emphasizing the advantages of American queen bees, such as high productivity, disease resistance, and scientifically sound breeding methods. Participation in international exhibitions, cooperation with large agricultural companies, and active participation in professional communities will help strengthen the reputation of American exporters.

Thus, improving the competitiveness of American exporters requires a comprehensive approach that includes improving product quality, optimizing logistics, strengthening scientific cooperation, and actively promoting the international market. Implementing these measures will strengthen the position of American manufacturers and increase confidence in their products among foreign partners.

Conclusions. In the course of the study, the goal was achieved, and the main tasks were solved, which contributed to the comprehensive results. The analysis of the current state of the queen bee and bee packages market in Canada and England showed significant demand for imported products due to limited domestic production capabilities, especially in Canada. Domestic production of queen bees in this country covers only a small share of the demand, forcing Canadian beekeepers to actively import queen bees from warmer climates such as California, Hawaii, New Zealand and Australia. There is also a high demand for high-quality breeding material in England, which creates prospects for expanding exports from America. The main factors affecting the economic efficiency of exports are identified,



including the costs of production, transportation, certification, and customs clearance. Production costs include the cost of rearing queen bees and forming bee packages, as well as the cost of care, selection, and ensuring high-quality products. Logistics costs are associated with international delivery, and there is a need to maintain optimal conditions during transportation and minimize losses. Certification and veterinary control play an important role, as they require compliance with international quality and health standards for bees and the receipt of relevant certificates that increase the trust of importers. In addition, the costs and time spent on customs procedures have a significant impact on the speed of delivery and competitiveness of products. Based on the results obtained, the article develops practical recommendations for improving the competitiveness of American exporters in the international market. In particular, it is advisable to optimize production processes to reduce the cost of queen bees and packages without losing quality, improve logistics schemes to ensure the fast and safe delivery of products to Canada and England, actively use modern methods of selection and quality control to ensure a high level of products that meet international standards and simplify certification and customs clearance procedures through the introduction of electronic document management and cooperation with accredited bodies.

The results obtained are of great practical importance for the development of a strategy for the export of queen bees and bee packages from America, which will help to increase competitiveness in the international market and meet the needs of importers for high-quality breeding material.

Prospects for further research include a deeper analysis of the economic efficiency of exports of queen bees and bee packages, taking into account seasonal fluctuations in supply and demand in the international market. An important area is to study the impact of climate change on the production and export of queen bees, as well as to develop strategies to minimize the risks associated with the transportation of live products.



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