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DETERMINATION OF OPTIMAL CENTERS FOR LOCATION OF AREAS OF EGGS SUPPLY FOR GANJA-DASHKASAN AND KAZAKH-TOVUZ ECONOMIC REGIONS

The purpose of the article. Most of the products of the main demand among livestock products are perishable products. Along with the requirements attributed to the quality of this category of products, the requirements for their storage distinguish them from other products. This feature is due to the need to maintain the required temperature regime throughout the entire period of existence of perishable products, from the moment of their manufacture to the moment of consumption. Thus, the quality of the transported product is ensured, on which the safety of the population directly depends.

Thus, the process of transporting perishable products is considered actual in its essence. This makes it necessary to investigate, analyze and solve existing problems in the specified area. This article is devoted to the problem of transportation of eggs to the supply points of livestock products produced in farms.

The methodology and methods used are the theoretical and methodological basis of the research, the works of local and foreign scientists dedicated to the deployment of production forces, the transport provision of cargo transportation, as well as the operation of the collector transport system, scientific literature on statistics, probability, graphs and management theories, economic mathematical modeling.

The main scientific innovation put forward is the development of the methodology, mathematical model of the optimal location of supply and reception points in the territory according to the minimum cost of transportation and the maximum profit, and the determination of optimal centers.

The result of the research is the determination of the optimal location centers by establishing a mathematical model of the supply points of the eggs belonging to livestock products in Ganja-Dashkasan and Gazakh-Tovuz economic regions. Based on the software developed in the MathCAD computer optimization system, it is possible to determine the coordinates of the optimal location centers of the supply points, which are considered relevant as a large-scale problem in a short period of time. The high accuracy and authenticity of the obtained results indicate the possibility and significance of the wide application of the developed methodology in agriculture.

Keywords: supply point, farm, livestock products, optimal location, transportation of eggs

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ВИЗНАЧЕННЯ ОПТИМАЛЬНИХ ЦЕНТРІВ РОЗТАШУВАННЯ РАЙОНІВ ЗАБЕЗПЕЧЕННЯ ЯЙЦЯМИ ГЯНДЖІНСЬКО-ДАШКАСАНСЬКОГО ТА КАЗАХСКО-ТОВУЗСЬКОГО ЕКОНОМІЧНИХ РАЙОНІВ

Мета статті. Більшість продуктів основного попиту серед продуктів тваринництва є швидкопсувними. Поряд з вимогами, що пред'являються до якості даної категорії продукції, її відрізняють від іншої продукції вимоги до її зберігання. Ця особливість обумовлена необхідністю підтримувати необхідний температурний режим протягом усього періоду існування швидкопсувних продуктів, від моменту їх виготовлення до моменту споживання. Таким чином забезпечується якість товару, що транспортується, від чого безпосередньо залежить безпека населення.

Таким чином, процес транспортування швидкопсувних продуктів вважається актуальним за своєю суттю. Це зумовлює необхідність дослідження, аналізу та вирішення існуючих проблем у вказаній сфері. Дана стаття присвячена проблемі транспортування яєць до пунктів постачання продукції тваринництва, виробленої в господарствах.

Теоретико-методологічною основою дослідження є методика і методика, праці вітчизняних і зарубіжних вчених, присвячені питанням розміщення виробничих сил, транспортного забезпечення перевезень вантажів, а також функціонування системи колекторного транспорту, наукова література. зі статистики, ймовірності, графіків і теорій управління, економіко-математичного моделювання.

Основна наукова інновація, що висувається, – розробка методології, математичної моделі оптимального розміщення пунктів постачання та прийому на території за мінімальними витратами на транспортування та максимальним прибутком, визначення оптимальних центрів.

Результатом дослідження є визначення оптимальних центрів розміщення шляхом створення математичної моделі точок постачання яєць тваринницької продукції Гянджа-Дашкасанського та Газах-Товузського економічних районів. На основі програмного забезпечення, розробленого в системі комп'ютерної оптимізації MathCAD, можна за короткий проміжок часу визначити координати оптимальних центрів розташування точок постачання, які вважаються актуальними як масштабна задача. Висока точність і достовірність отриманих результатів свідчать про можливість і значимість широкого застосування розробленої методики в сільському господарстві.

Ключові слова: пункт постачання, ферма, продукція тваринництва, оптимальне розташування, транспортування яєць

Introduction (problem statement)

The process of production and sale of livestock products in Ganja-Dashkasan and Gazakh-Tovuz economic regions, the modern state of the placement of enterprises for the supply and processing of products were analyzed according to the scale, structure, variety of products produced, features of production technology and formulated the existing problems. These problems include lack of resources and unevenness of raw materials, obsolescence of equipment, limited assortment of produced products, strict restrictions on long-term storage of raw materials and

products, poor network of supply points, poor location of processing plants in the area in relation to producers and demand makers, large number of producers of raw products and short-term satisfaction of demand, small batch factors can be attributed.

In recent years, in the research works of a number of scientists in the publications published on the topic, a certain place is given to such problems as transportation, production and delivery of livestock products from farms to processing enterprises.

The optimal placement of the processing enterprise and the minimization of the costs of transporting the product to the enterprise were discussed in the articles of scientists such as Sadikhova M.S. "Factors of placement of the enterprise processing livestock products in the territory", Ismayilov I.I., Sadikhova M. Sh. "Methods of delivery of milk from farms to processing enterprises and parameters of vehicles", Sadikhova M.Sh., Ismayilov I.I. "Optimal placement of livestock processing enterprises and supply centers." [4, p. 166; , 7, p. 122; 3, p. 47].

The scholars Aliyev K.I., Huseynov S.T. addressed the issue of economic limitations in optimization. By reviewing his scientific work "Determining the optimal center for placing objects in the MATHCAD computer system", mathematical modeling methods of planning experiments and identification of static and dynamic systems, mass service systems, and models were considered. The theoretical presentation was accompanied by numerous examples and programs in the Mathcad system [1, p. 27].

The proposed main scientific innovation is the justification of the efficiency of the implementation of the schemes for the transportation of livestock products from the producer to the supply points and processing facilities; development of the methodology, mathematical model of the optimal location of supply, reception points and processing enterprises in the area with minimum transportation costs and maximum profit and determination of optimal centers; justification of optimal transport provision of transportation of livestock products to conveniently located supply and processing centers.

It consists in the fact that the results of the study are applied by supply and processing points and enterprises, as well as large livestock farms in order to agree on the interests of all participants in the process of transportation of livestock products, to improve the efficiency of transportation during the selection of transportation schemes.

Recommendations developed on the placement of optimal centers of supply points and processing enterprises for the transportation of livestock products in the territory of Ganja-Dashkasan and Gazakh-Tovuz economic regions and transport provision allow to ensure the protection of products in the process of transportation and increase the quality of the services provided.

The problem of choosing the location of the processing plant and supply points **for the presentation of the main material** aims to choose the most economically advantageous option for managing the flows between the producer farms and the processing plant as the consumer from the point of view of affordability [2, p. 22].

The minimization of transportation costs for the transportation of raw materials to the processing plant, which is one of the main factors in determining the location of the processing plant and supply points, should also be considered.

In order for the production to be organized correctly, the raw materials to be transported to meet the relevant requirements and meet the quality, the transportation of raw materials from the farms where they are produced to the processing plant and supply points must be carried out by means of transport of the processing plant.

From this point of view, the question can be formulated in the following terms: the processing facility and supply point where the raw materials will be transported should be located in the service area as much as possible so that the transportation costs are minimal. For this, the amount of work on transporting the raw product from farms where it is produced should be calculated and such a center should be chosen so that this work could be minimal.

Therefore, it is necessary to develop a simpler and more applicable method of convenient placement of processing and supply points for a specific area.

Food security is valued as the most important component of the national-economic security system of all countries of the world. The food security of each country is considered to be ensured within the defined conditions. The first of these conditions is that more than 85% of food products for mass consumption are produced by the local agricultural sector. The development of food industry, agriculture and especially poultry farming is an integral part of the food security of every country [6, p. 41]. Therefore, the issue of optimal location of processing facilities in the area should be resolved in order to ensure the transportation of the main livestock products produced on farms in a specific region to primary processing facilities and supply points at minimum cost. The main livestock products are meat, milk, eggs, etc. These products are divided into perishable products and products that can be stored under certain conditions. Since the product under investigation is eggs, the approach here should be the same as transporting eggs to supply points [2, p. 88].

As mentioned, in the issue of the optimal location of the processing enterprise, the minimization of the costs of transporting the product to the enterprise is considered the main condition [1, p. 27; 3, p. 47]. This is possible on the condition that the distances between the place where the product to be transported is produced and the supply points are minimal. That is, the processing facility should be located in the area in such a way that it is at an optimal distance from all production facilities [4, p. 167; 5, p.7].

Since the issue of transporting eggs to the supply point is optimized, here the quantities of the mathematical model must be matched with the indicators of the corresponding product.

In the case of constrained optimization, the physical, technical and economic parameters of the problem should be taken into account, while the objective function and constraints are the same, and the measurement units should

correspond to their quantity. That is, in the case of egg transportation, the units of measurement should be 1000 eggs.

Considering this point, the mathematical expression of the optimization function and the constraint conditions of the issue of the optimal location of the supply point where eggs will be transported will be in the following way:

$$
\begin{cases}
i = 1, \ldots, N, \\
f\left(\sum_{i=1}^{N}\left[\begin{pmatrix} x \\ y \end{pmatrix} - P(x_i, y_i)\right]\right) \to min, \\
k_i\sqrt{(x - x_i)^2 + (y - y_i)^2} < (r_i q_i - (c_i + s))L_i.
\end{cases}
$$

Here: c_i - is the price of eggs from farmers (raw material price);

s – The cost of 1000 egg products, manat;

k_i –L_i total number of eggs from the farm (district) to the center ΔS_l is the transportation cost per 1 km of delivery;

$\Delta S_i = \sqrt{(x - x_i)^2 + (y - y_i)^2}$ - is the length of the straight line path from the (x, y) coordinate center to point *i* to be determined;

r_i –coefficient of variation of L_i quantitative raw material in technological process (decrease or increase, this value can be taken as an equal constant value in the first approximation, i.e r_i =1=const);

q_i – selling price of 1000 egg products in the center.

Determining the optimal placement center of the egg supply point for Gazakh-Tovuz economic region.

The graphs reconstructed in Excel (due to certain graphical limitations in MathCAD) of the results obtained in MatCAD for the egg supply point for the Gazakh, Agstafa, Tovuz, Shamkir and Gadabey district group, that is, the results obtained based on the numerical solution, are given in figure 1.
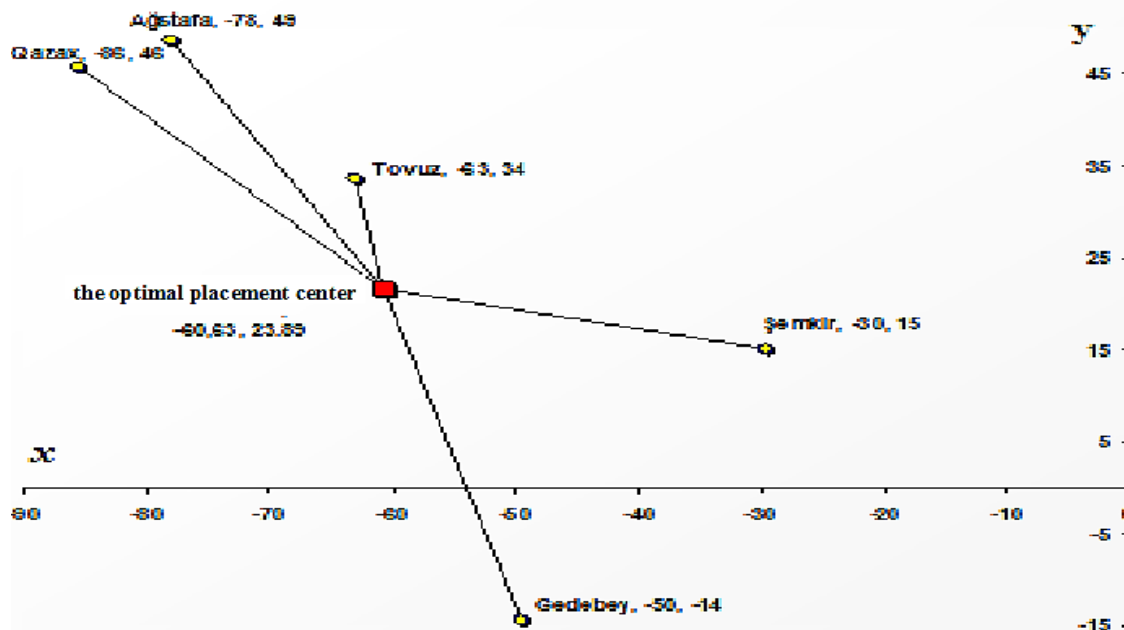

Fig.1. The scheme of the optimal placement of the egg supply point for the Gazakh-Tovuz economic region. Source: [7, p. 106]

As can be seen from Figure 1, the location of the egg supply point for the Gazakh-Tovuz economic region in the area close to the Tovuz region is considered optimal, with the point between the Tovuz and Shamkir regions, compared to the general supply option for both economic regions.

Determining the optimal placement center of the egg supply point for Ganja-Dashkasan economic region. The matrix of the obtained solution for the egg supply point for ganja city, Dashkesan, Samukh, Goygol and Goranboy region Group, the coordinates of the optimal placement center, the calculation of the stacks providing the indication of distances in the graph, the calculation of the goal function and limits and the graphs of the obtained results reconstructed in Excel are given in figure 2.

From Figure 2 it can be seen that the egg supply point for Ganja-Dashkasan economic region is considered optimal to be located at a coordinate point of 4.01; -4.59 between Ganja city and Goranboy region in comparison with the supply option for both economic regions.

A comparative scheme of the coordinates of the optimal placement centers for individual district structures and joint egg supply points of these economic regions based on the reconstructed graphs of the obtained results in Excel is given in Figure 3.

From Figure 3 it can be seen that when the egg reception point is placed in the General District, it is considered optimal to place it at a coordinate point of -30.39; 17.94 in the Central Shamkir district. In the optimal placement option for two groups of regions, it is considered optimal to place the reception point in the I and II reception points with coordinates -60.74; 21.67 and 4.01;-4.59.
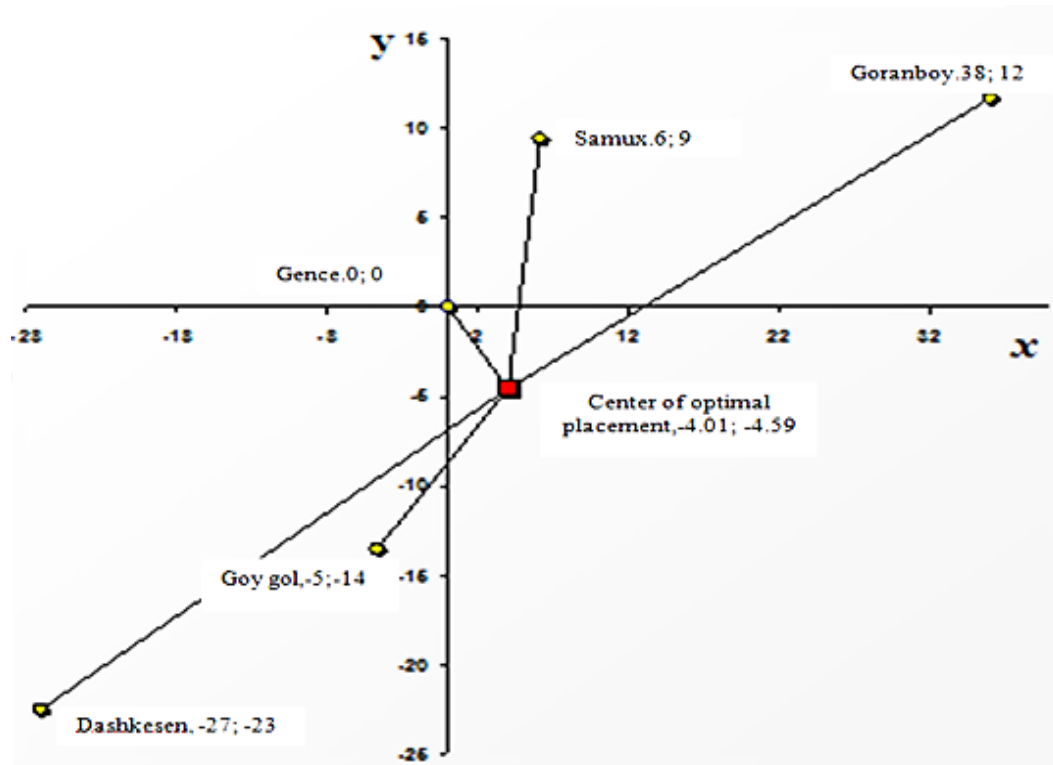
Fig.2. The scheme of the optimal placement of the egg supply point for Ganja-Dashkasan economic region. Source: [7, p. 108]

Comparison since the minimum cost of transportation of a unit of cargo is conditional, the option of placing 2 reception points is considered favorable in relation to the placement in general districts. It is the low carrying distance that ensures the minimization of transportation costs here. Thus, the distance from Gazakh region is 86.46 units, distance from Agstafa region is 78.49 units for Dashkasan region through Ganja city and 57.39 units is not considered favorable.
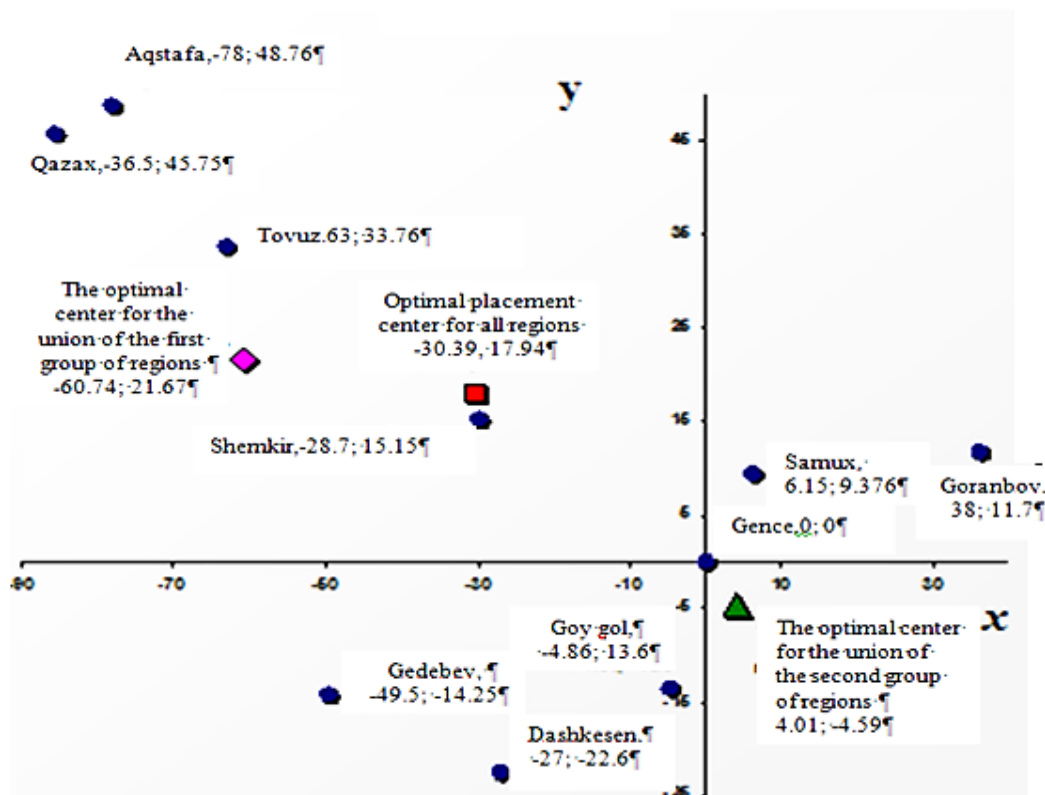

Fig. 3. Comparative scheme of the coordinates of optimal placement centers of egg supply points in Ganja-Dashkasan and Gazakh-Tovuz economic regions Source: [7, p. 109]

In the option of placement with district groups, these distances are divided into two parts, and since the distances between other district centers are also reduced, the determined placement options are considered optimal.

Result

Based on the analysis of the existing theories on the location of production forces and the determination of the coordinates of the location points, a methodology for determining the optimal location and coordinates of the supply points where livestock products are transported by simple, more accurate computer optimization was developed.

Based on the software developed in the MathCAD computer optimization system, it is possible to determine the coordinates of the optimal location centers of the supply points, which are considered relevant as a large-scale problem in a short period of time, and to give graphs as a result of the report. The high accuracy and authenticity of the obtained results indicate the perfection and importance of the wide application of the developed methodology in agriculture.

It has been established that due to the minimum cost of transportation of a unit of cargo: - due to the high cost of transportation from Gazakh, Agstafa and Dashkasan regions in the optimal placement option for all regions, it is considered optimal to place 2 supply points in the 1st group of districts-Gazakh - Tovuz economic region with coordinates -60.74 and 21.67 in the territory of Tovuz region, and the 2nd group of districts-Ganja-Dashkasan economic region with coordinates 4.01 and -4.59;

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